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The escalating prevalence of psychological distress among young adults is a systemic issue with a generational impact as evidenced by patterns of insecure attachment, maladaptive self-regulation, and, accordingly, mental health problems (Stallard, Norman, Huline-Dickens, Salter, & Cribb, 2004). There is a call for holistic approaches to prevention, assessment, and treatment that reduce the occurrence and impact of mental health problems among adults and their families (WHO, 2004). As such, researchers have identified a need to investigate the psychobiology of attachment (Diamond & Hicks, 2004), including emotional and physiological processes involved in self-regulation. Breathing is a physiological process that is critical to both physiological (Courtney, Cohen, & van Dixhoorn, 2011a) and emotional regulation (Koole, 2009). Exploration of the psychobiology of attachment could inform the advancement of holistic strategies in mental health (Diamond & Fagundes, 2010) and breathing appears to be a logical construct for examination in this context.

An exploratory cross-sectional correlational study was used to examine the relationships among the variables of adult romantic attachment, emotion-regulation difficulty, and symptoms of dysfunctional breathing in a sample of 203 young adults. Results of Pearson correlations indicated that there were statistically significant bivariate positive relationships among attachment anxiety, attachment avoidance, difficulty regulating emotion, symptoms of hyperventilation, and symptoms of dysfunctional breathing. Three one-way ANOVA's indicated that there were significant differences in

scores of attachment anxiety, attachment avoidance, and difficulty in emotion regulation among individuals who reported symptoms of hyperventilation who indicated either normal, mild, or clinically significant symptoms. The results of two multiple regression analyses indicated that a significant portion of the variance in both attachment avoidance and attachment anxiety was accounted for by symptoms of hyperventilation. Another multiple regression indicated that attachment dimensions, dysfunctional breathing, and hyperventilation accounted for 45% of the variance in emotion regulation difficulty. A hierarchical multiple regression indicated that the relationship between dysfunctional breathing, hyperventilation, and difficulty regulating emotion was not moderated by attachment insecurity. Though causal conclusions cannot be drawn, these results indicate preliminary support that addressing issues of dysfunctional breathing could complement mental health approaches aimed at promoting secure attachment and adaptive self-regulation.

INVESTIGATING THE RELATIONSHIPS AMONG BREATHING, ATTACHMENT, AND EMOTION-REGULATION

by

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CHAPTER I

INTRODUCTION

With the increasing prevalence of mental health issues worldwide, accompanying human suffering, disability, disease, and economic burdens continue to rise. Meanwhile, for many individuals treatment remains either inadequate, ineffective, or inaccessible (Funk, Drew, Freeman, & Faydi, 2010). For example, it is estimated that over 350 million people suffer from depression (WHO, 2013). Further, depression is believed to be a major contributor in the development of chronic medical disease, and depression is the top cause of disability world-wide. The lifetime prevalence of depression among the U.S. population is about 11.7% among women and 5.6% in men (Centers for Disease Control and Prevention, 2013). Similarly, anxiety disorders represent the most common mental health symptoms in the U.S. general population, with a lifetime prevalence of about 15%. The onset of depression and anxiety often occurs in young adulthood by the age of 30 (Kessler, Petukhova, Sampson, & Zaslavsky, 2012) and nearly 75% of lifetime mental health problems are thought to appear by age 24 (Park, Paul Mulye, Adams, Brindis, & Irwin, 2006; Suvisaari et al., 2009). In addition to the impact of the symptoms themselves, individuals with ongoing mental health issues also may experience higher incidence of physical and sexual abuse as well as social, educational, and occupational difficulties (Funk et al., 2010). The scope of this mental health problem is compounded by the effect that these issues have not only on the individual with the

symptoms but also on family members, most notably children (Stallard et al., 2004). Specifically, the escalating prevalence of psychological distress among young adults is considered a systemic issue and thus may create and reinforce generational patterns of insecure attachment, maladaptive self-regulation, and, accordingly, continued mental health problems for individuals and within families (Stallard et al., 2004).

Interactions between genetic, biological, psychological, and social factors are thought to shape mental health from generation to generation (WHO, 2004). For example, researchers recently conducted a longitudinal study and reported that the risk at age 11 of experiencing mental health issues that meet the criteria for a psychiatric disorder was four times greater among children of mothers who experienced depression (Pawlby, Sharp, Hay, & O'Keane, 2008). Many adult mental health issues begin in childhood or adolescence and it is estimated that approximately 20% of children and adolescents worldwide experience mental health problems (WHO, 2013b). This may be a reflection, at least in part, of the role of attachment and attachment related processes in genetic, biological, psychological, and social development (Schore & Schore, 2008) and, accordingly, the occurrence, maintenance, and transference of psychological distress. Thus, the escalating prevalence of psychological distress among young adults may create and reinforce generational patterns of mental health issues among their families. Researchers have suggested that these generational patterns are accompanied by a long term increase in

- attachment problems (WHO, 2012);
- susceptibility to disability and disease (WHO, 2013b);

- abuse, neglect, and/or impaired social and educational functioning (WHO, 2012).

Thus, increased efficacy and accessibility in the treatment of young adult mental health issues is not only imperative for adult holistic health but also as a prevention of distress, disability, disease, social and economic hardship among future generations.

Current mental health treatments include a host of therapeutic approaches and psychotropic medications. Though efficacy of mental health treatments have improved in past years (WHO, 2004), treatments (and treatment outcomes) vary widely depending on the client's presenting concern, client-counselor therapeutic relationship, treatment setting, clinician training, and both client and community resources. Broadly, there is a great need for improvement in quality treatment and outcomes in mental health care (NIMH, 2013). In the counseling field, in particular, the goal of mental health treatment is not merely symptom relief but rather the promotion of holistic health. In fact, health is defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948, p. 100). Holistic mental-health interventions are needed to meet the call for effective, affordable, accessible treatment and prevention to promote sustainable positive holistic health outcomes (Baron & Faubert, 2005; Kraemer & Marquez, 2009), reduce stress-related holistic health problems (WHO, 2005), and, more specifically, to reduce the occurrence and impact of mental health problems among adults and their families (WHO, 2004).

Integrative mind-body-spirit approaches are one promising avenue toward this end (NIH, 2013; Tsang, Chan, & Cheung, 2008) and can be utilized to address developmental, relational, and psychobiological needs. Researchers (Pilkington,

Kirkwood, Rampes, & Richardson, 2005) have reported that clients and counselors also may turn to mind-body-spirit approaches due to a) adverse side effects, inefficacy, or inaccessibility of psychotropic medications; b) dissatisfaction with traditional psychotherapy; or c) personal preference for holistic approaches.

Historically, scientists have considered mind, body, and spirit to be independent entities but many researchers now view mind, body, and spirit as inextricably interdependent (Aravinda Prabhu, Bhat, & Prabhu, 2013; Myers & Sweeney, 2005). As incidence of medical and mental health problems rise, researchers and practitioners call for action on this mind-body-spirit paradigm shift (Booher, 2013). For instance, organizations such as the National Institutes for Health (NIH) have increased their efforts to improve holistic health by supporting research on these mind-body relationships (NIH, 2013) in human development and psychopathology. Further, attachment and attachment related processes have been identified as fundamental to understanding and promoting healthy human development, including behavioral and neurobiological systems (Schore & Schore, 2008), across the lifespan and across generations (WHO, 2004). Consistent with this holistic view of health and attachment, the National Institute of Mental Health (NIMH) encourages researchers to focus on the genetic, neurobiological, behavioral, environmental, and experiential factors that contribute to psychological distress (NIMH, 2010). Accordingly, medical and mental health professionals alike have worked to increase our understanding of mind-body-spirit relationships and interventions appropriate for medical and mental health treatment and supporting holistic health and

wellness. Thus, across helping professions, professionals utilize and advocate for integrative approaches with growing empirical support.

Attachment Theory, "an ethological approach to personality development" (Ainsworth & Bowlby, 1991, p. 333), was developed based on a psychoanalytic foundation and integrated concepts from ethological, systems theory, security theory, cognitive theory, behavioral theory, and evolutionary biology to form a theory of human development. Thus, researchers studying Attachment Theory have for many years been investigating, both implicity and explicitly, the mind-body-spirit connection. Attachment Theory has emerged as a promising framework for understanding the interplay of nature and nurture in human development (Schore & Schore, 2008), investigating the related psychobiological regulatory processes (Diamond & Fagundes, 2010), and developing effective approaches to prevention and intervention in various mental health issues across the lifespan (Diamond & Hicks, 2004). Specifically, there is a need to study psychobiological profiles of attachment (Diamond & Hicks, 2004) in order to treat mental health issues, improve self-regulation (Hofer, 2006), and promote holistic health across generations. Self-regulation, including both physiological regulation and emotional regulation, may be key factors in understanding attachment processes in the context of human development and family-related protective factors (Calkins, 2004; Padykula & Conklin, 2009). Investigating specific physiological processes that are essential to both effective self-regulation and interpersonal communication may offer valuable insight in this area.

Breathing is a physiological process that has been shown to be highly influential in the regulation of both physiological systems (Courtney et al., 2011a) and emotion (Koole, 2009). In fact, researchers have argued that it is vital to explore the psychophysiology of attachment in order to develop effective assessment, prevention, and intervention strategies to reduce mental health problems and related outcomes (Diamond & Fagundes, 2010), and breathing appears a viable psychophysiological construct for empirical examination.

Breathing

Breath-related interventions are gaining popularity among mind-body-spirit practitioners, and have increasing empirical support in the treatment of some mental health issues (Brown & Gerbarg, 2009; Cusens et al., 2010; Young, Cashwell, & Giordano, 2010). Characteristics of breathing are associated with both physiological (Courtney, 2009) and emotional regulation (Koole, 2009). Further, characteristics of breathing have a significant influence on both verbal and non-verbal interpersonal communication, including facial expression (Demaree, Pu, Robinson, Schmeichel, & Everhart, 2006), posture and movement (CliftonSmith & Rowley, 2011), and vocalization (Ley, 1999). Though some characteristics of breathing patterns do vary throughout daily life depending on various factors such as diet and activity, preliminary investigations (Benchetrit et al., 1989) have indicated that overall profiles of breathing may be identified and that emotion and cognition also are reflected in breathing patterns (McCraty & Childre, 2002; Philippot, Chapelle, & Blairy, 2002). It is thought that chronic stress responses lead to sustained negative emotional states as seen in mental

health problems such as depression and anxiety (Schore & Schore, 2008). In an attempt to restrict or avoid these negative feelings, individuals may learn to consciously or unconsciously constrict breathing patterns (Elliott & Edmonson, 2008). Emotion-regulation in response to negative stimuli via acute changes in breath such as frequency, restricted depth, or diaphragmatic restriction may be adaptive short-term responses. When these responses become chronic, however, the long-term result of these regulation attempts is maladaptive as evidenced by sustained habitual stress response patterns (McCraty & Childre, 2002), symptoms of dysfunctional breathing, and difficulty regulating emotion.

Symptoms of dysfunctional breathing or patterns of maladaptive breathing symptoms such as hyperventilation syndrome may be valuable in the investigation of physiological profiles that may be associated with patterns of attachment and self-regulation. Characteristics of dysfunctional breathing are associated with a range of symptoms of psychological distress including depression (Blazer & Hybels, 2010) and anxiety (Brenes, 2003). Fortunately, with intervention and practice, individuals can learn how to restore healthy breathing (Courtney et al., 2011a; Ritz & Van den Bergh, 2010), reduce related psychobiological symptoms (Ritz & Van den Bergh, 2010), and promote holistic well-being (Brown & Gerbarg, 2009). Still, there is much about the relationships between breathing, human development, and mental health that remains unknown. Since individuals emotional and physiological functioning is thought to be shaped, and to varying degrees across the lifespan coregulated, by attachment figure(s) (Butner, Diamond, & Hicks, 2007; Feldman, 2003; Zelenko et al., 2005) and breath pattern

impacts both emotional (Philippot et al., 2002) and physiological functioning (Courtney et al., 2011a), it is possible that breathing might also be a process related to conscious and non-conscious attachment processes. As such, understanding the relationships between attachment, breathing, and emotion-regulation may be a promising avenue for more effectively understanding and addressing the psychobiology and generational transference of psychological distress.

Attachment Theory and Self-Regulation

Ainsworth and Bowlby (1991) conceptualized the attachment system as encompassing essential psychobiological processes that form the foundation of survival responses and capacity for an individual to adapt to life. Healthy attachment styles or strategies in family relationships are believed to act as protective factors and reduce risk for development of mental and physical illness over the course of lifespan development (WHO, 2004). These protective factors may be due to the impact of attachment processes on the development and maintenance of self-regulation strategies (Calkins, 2004). Researchers have empirically supported the conceptualization of attachment processes as indices for emotion regulation strategies (Mikulincer, Shaver, & Pereg, 2003). Attachment processes also have been associated with physiological regulation including heart rate (Zelenko et al., 2005), heart rate variability (Schneiderman, Zilberstein-Kra, Leckman, & Feldman, 2011), vagal tone (Diamond, Fagundes, & Butterworth, 2012), brain development (Schore, 2009), and hypothalamic-pituitary-adrenal activity (Diamond, Hicks, & Otter-Henderson, 2008). Thus, researchers conceptualize attachment theory as a self-regulation theory in which attachment

processes shape both physical and emotional development, influencing both inter- and intrapersonal functioning over the lifespan (Calkins, 2004; Diamond & Fagundes, 2010; Schore & Schore, 2008). In other words, "the attachment model explains how repeated crucial interactions between infant and caregiver result in lifelong patterns of stress-response, receptivity to social support, and vulnerability to illness" (Maunder & Hunter, 2001, p. 556).

Attachment Styles and Self-Regulation

Often, attachment processes are measured in terms of *attachment style*. These measures of attachment style, also called attachment strategies, reflect patterns of attachment behaviors between an infant, child, adolescent, or adult and an attachment figure(s) and they are typically assessed in studies using the Strange Situation methodology, attachment interviews, or self-report measures of attachment (Fox & Hane, 2008). For infants, the attachment figure is the primary caregiver and for adults the primary attachment figure is usually a romantic partner or friend. Attachment styles are typically thought to be stable over time, though attachment styles may be relationship specific (La Guardia, Ryan, Couchman, & Deci, 2000). Still, changes in attachment style can occur and may be adaptive or maladaptive (Maunder, Lancee, Nolan, Hunter, & Tannenbaum, 2006). Though terms to describe attachment style vary throughout the literature, researchers generally agree that attachment includes tendencies in two dimensions (anxiety and avoidance) and, accordingly, reflect either secure (low anxiety, low avoidance) or insecure attachment (Main, 1996; Mikulincer et al., 2003; Schore & Schore, 2008). Commonly, insecure attachment styles may be characterized as anxious

(low avoidance, high anxiety), avoidant (low anxiety, high avoidance), or disorganized (high anxiety, high avoidance (Main, 1996; Schore & Schore, 2008).

Secure attachment is conceptualized as involving successful development of adaptive self-regulation and sense of self, and is evidenced by individuals who feel safe to explore their world, connect to others, and give and receive support (Ainsworth & Bowlby, 1991; Dickerson Peck, 2003; Schore & Schore, 2008). In infants, secure attachment is believed to be fostered by caregivers who respond consistently, sensitively, and appropriately to infant communications and positive and negative states (Ainsworth & Bowlby, 1991; Schore & Schore, 2008). For securely attached infants or children, the caregiver acts as an attachment figure who offers a safe haven when the infant or child experiences something threatening and also fulfills the role of safe base by providing familiar contact from which the infant or child is safe to explore and learn about her or his environment (Mercer, 2011). In this way, the attachment figure fulfills the role of external regulation and, over time, these processes are internalized by the infant or child (Calkins, 2004). Children and adolescents who experience secure attachment with caregivers have reduced risk for developing mental health issues such as depression and anxiety later in life (Jakobsen, Horwood, & Fergusson, 2011). In adults, secure attachment has been associated with adaptive emotion regulation strategies (Karreman & Vingerhoets, 2012) and positive interpretations of relationship experiences and facial expressions, behavior, and motives of others (Diamond & Aspinwall, 2003).

Insecure attachment may involve maladaptive physiological and emotional-regulation, evidenced by individuals who, to varying degrees, neither feel safe to explore

their world nor safe to connect with and support or receive support from others. Attachment processes may begin to be shaped prenatally as prenatal maternal stress may bias the developing infant's neurobiological development toward survival in a threatening rather than safe world (Thomson, 2007). Thus, attachment is impacted by both prenatal and postnatal experiences (WHO, 2012). Organized insecure attachment (i.e., anxious or avoidant) has been thought to be developed by caregivers who exhibit inconsistency and have difficulty attuning with the infant (Main, 1996; Schore & Schore, 2008). Disorganized attachment is thought to be primarily developed through caregiver abuse and/or neglect (Schore, 2001). Unlike the bias toward recollection of positive memories seen in individuals who experience a secure attachment style, individuals who experience an insecure attachment style have been found to have a bias toward recollection of negative memories (Steele, Steele, & Croft, 2008). This supports the assertion that attachment style may shape an individual's emotional regulation, meaning-making, and both interpretation and transmission of non-verbal communication (Schore & Schore, 2008; Steele et al., 2008). Fortunately, researchers have reported that attachment styles may shift through therapeutic intervention (e.g., Hertz, Addad, & Ronel, 2012; Travis, Bliwise, Binder, & Horne-moyer, 2001). As a result, it is possible to heal attachment injuries, improve self-regulation strategies, and promote the development of secure attachment strategies later in life (Travis et al., 2001). Further, researchers have shown that preventive work is also effective, as secure attachment can be supported in early child-caregiver relationships (Berlin, Zeanah, & Lieberman, 2008). Interventions promoting secure attachment strategies in adults may benefit the client's current and

future relationships, including the ability to foster secure attachment with romantic partners and future children. Thus, attachment related interventions may interrupt generational patterns of distress and promote adaptive development.

Attachment styles also have been empirically connected to self-regulation. Specifically, secure attachment has been linked to adaptive self-regulation in both childhood (Waters et al., 2010) and adulthood (Sbarra & Hazan, 2008). Adaptive self-regulation has been linked with effective coping skills, reduced risk for mental and physical disease, and a "psycho-neuro-physiological" foundation for holistic health (Frentzel-Beyme & Grossarth-Maticek, 2001, p. 81). Similarly, insecure attachment has been linked to maladaptive self-regulation (Sbarra & Hazan, 2008), which has been associated with mental health issues including poor self-care behaviors (such as smoking, alcohol consumption, poor diet), reduced coping skills, and feelings of hopelessness and helplessness (Frentzel-Beyme & Grossarth-Maticek, 2001). Though there is a large body of empirical research that shows attachment-related processes to be associated with self-regulation, there is no consensus on the definition of self-regulation nor the sub-components of self-regulation that are consistent with attachment theory (Padykula & Conklin, 2009; Sbarra & Hazan, 2008). Nonetheless, physiological and emotional regulation are considered primary features in both an individual's overall ability to self-regulate and develop secure attachment (Diamond & Fagundes, 2010).

Though they are often studied as separate phenomena, emotional and physiological regulation are inter-related. Researchers have hypothesized that if there is a causal relationship between physiological regulation and attachment strategies, it likely

manifests in relationships between attachment, hypothalamic-pituitary-adrenal activity (HPA), and/or ANS functioning (vagal/parasympathetic and sympathetic; Diamond & Fagundes, 2010; Maunder et al., 2006). For the purposes of the present study, the focus of physiological regulation and attachment was on ANS functioning due to the relationships between ANS functioning and processes of breathing. Heart rate variability (HRV), a measure of ANS functioning, reflects the ability to adapt physiological arousal (consciously or unconsciously) depending upon the environmental context and stimulus. This skill of physiological regulation is considered critical for emotion regulation (McCraty & Childre, 2002). Healthy HRV is associated with reduced symptoms of mental health problems, improved physical health, and increased well-being (McCraty & Childre, 2010). Relationships between HRV and attachment style have been established in studies investigating the role of attachment and ANS functioning (e.g., Diamond, 2005; Schneiderman, Zilberstein-Kra, Leckman, & Feldman, 2011).

Further, characteristics of breathing play a critical role in HRV regulation (Courtney et al., 2011a). Thus, it is possible that breathing may play an important role in the relationships between self-regulation and attachment. In other words, breathing may be a key process not only in physiological health and development but also in psychobiological health and development involved in attachment related processes, but this hypothesis has not been empirically examined to date.

Statement of the Problem

Attachment (Sroufe & Siegel, 2011), self-regulation (emotional and physiological; Diamond & Aspinwall, 2003), and breath (Elliott & Edmonson, 2008)

related processes have been identified individually as key factors in the development and/or maintenance of wellness versus distress. Though therapeutic interventions have been shown to positively impact each of these factors independently, there also have been limitations in both understanding and application. For instance, researchers have found mixed results on the stability versus adaptability of attachment style in adulthood (e.g., Strauss, Mestel, & Kirchmann, 2011; Travis et al., 2001). Researchers have suggested that the psychobiological factors of attachment processes (Diamond & Fagundes, 2010; Schore & Schore, 2008) may explain significant positive change in attachment strategies for some clients (e.g., Travis et al., 2001) while not in others (e.g., Strauss, Mestel, & Kirchmann, 2011). Although both attachment style and breathing have separately been associated with emotion-regulation (e.g., Calkins, 2004; Karreman & Vingerhoets, 2012; Takase & Haruki, 2001) and physiological regulation strategies (e.g., Diamond & Fagundes, 2010; Roisman, Tsai, & Chiang, 2004), there is much that is not yet understood about the relationships between these constructs and how they can be effectively integrated in the assessment, treatment, and prevention of mental health issues. It is possible that understanding these relationships may give valuable insight into the psychobiology of attachment and, accordingly, shed light on areas where research to date has been mixed or inconclusive. At this point, however, despite the empirical evidence to support relationships among these constructs, researchers have not explicitly studied the relationships between attachment, breathing, and emotion-regulation. Further, the psychobiological foundations of attachment systems, particularly attachment communication, have not been studied with depth (Feldman, 2006). Finally, a review of

the existing literature suggests that the explicit role of breathing in attachment processes has not been investigated. Although attachment, emotion regulation, and breathing are relevant across the lifespan, investigating the relationships among these constructs in a sample of young adults is a critical first step in exploring the relationships between these constructs. Most young adults strive to achieve developmental goals, including establishing a committed romantic partner, a household, and, in many cases, becoming an effective parent (Hartmann & Swartz, 2006). Often, successful achievement of these goals is limited by mental health problems (Suvisaari et al., 2009) that can have a general impact on the entire family system. It is possible that integrative approaches drawing upon relationships among attachment, emotion regulation, and breathing may offer uniquely potent mind-body-spirit benefits

Purpose of the Study

Although researchers have found support for relationships between attachment and emotion-regulation (e.g., review by Calkins, 2004) and breathing and emotion-regulation (e.g., Butler, Wilhelm, & Gross, 2006; Takase & Haruki, 2001), the relationships among all of these constructs have not been investigated together. Thus, the primary purpose of this study was to begin to address this gap in the literature by exploring the relationships among attachment, breathing, and emotion-regulation in a sample of young adults. By exploring relationships among these constructs, this study investigated the psychobiology of attachment including what dimensions of breathing dysfunction are associated with attachment style and emotion regulation difficulty. Addressing this gap in the literature may begin to inform significant advancement in

holistic prevention, assessment, and treatment of mental health issues and the related social, economic, and physical health problems.

Research Questions

Research Question 1: What are the relationships among romantic attachment (anxiety and avoidance dimensions), emotion regulation difficulties, dysfunctional breathing symptoms, hyperventilation, and diagnosis of breathing problems in a young adult sample?

Research Question 2: Are there differences in romantic attachment anxiety and romantic attachment avoidance and difficulty in emotion regulation among individuals who report symptoms of hyperventilation that indicate either clinically normal, mild, or significant symptoms of hyperventilation in a sample of young adults?

Research Question 3: What percentage of the variance in romantic attachment (anxiety and avoidance dimensions) is accounted for by breathing symptoms (symptoms of hyperventilation and dysfunctional breathing) in a sample of young adults?

Research Question 4: What percentage of the variance in emotion regulation difficulty is accounted for by breathing symptoms (hyperventilation and dysfunctional breathing), and romantic attachment dimensions in a young adult sample?

Research Question 5: Are the relationships between breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty in a young adult sample moderated by romantic attachment (dimensions of avoidance and anxiety)?

Need for the Study

Understanding human development and promoting holistic wellness are primary goals of the counseling profession. Still, key aspects of development and wellness, including attachment, emotion-regulation, physiological regulation, psychobiology, and generational transmission of wellness and distress have been minimally investigated. An initial exploratory investigation of the relationships among attachment, breathing, and emotion-regulation is needed to begin to bridge this gap. Advancing the understanding of relationships among these constructs could inform broadly applicable future development and implementation of holistic and culturally appropriate approaches to assessment, prevention, and treatment in mental health counseling. Because attachment, breathing, and emotion regulation are factors that are thought to be relevant to human development across the lifespan for individuals from all walks of life, the application of advanced understanding in this area could be far reaching. Further, advancement in this area may allow more customized treatment by addressing the individuals interpersonal, intrapersonal, and psychobiological patterns on multiple dimensions. Potential benefits of this area of study include improved efficacy and sustainability in assessment, treatment and prevention of adult mental health issues; reduced related child holistic health issues; reduced abuse/neglect and involvement in the child welfare system; and promotion of long-term holistic wellness among adults and their families.

Definition of Terms

There are several terms in this study for which the definitions have not gained consensus in the literature. For the purpose of clarity, these terms are defined as follows:

Attachment is defined as an intricate relational feedback system that shapes the individual's adaptive or maladaptive self-regulation as seen in secure or insecure attachment styles, respectively (Mercer, 2011; Schore & Schore, 2008; Steele, Steele, & Croft, 2008).

Attachment styles, or attachment strategies, are patterns of attachment relationship between infants, children and adults and attachment figure(s) across the lifespan; the identification of these patterns of attachment relationship emerged through empirical study (Ainsworth & Bell, 1970; Main, 1996). According to attachment theory, attachment style is believed to manifest on the two independent dimensions of anxiety and avoidance (Mikulincer et al., 2003) as measured by the Experience in Close Relationship – Revised (Fraley, Waller, & Brennan, 2000).

Breathing, also termed respiration, is defined as a complex regulatory process involving a variety of body feedback systems (Altose & Cherniack, 2005; Courtney et al., 2011a). Symptoms of dysfunctional breathing include breathing restriction and breathing pattern dysfunction as measured by the Self Evaluation of Breathing Questionaire (Courtney & Greenwood, 2009) and symptoms of hyperventilation as measured by the Nijmegen Questionnaire (van Doorn, Folgering, & Colla, 1982).

Emotion regulation can be defined as the internal regulatory processes used to consciously or unconsciously direct and redirect the course of emotional responses (Diamond & Aspinwall, 2003; Koole, 2009) as measured by the Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004). In the literature, the terms emotion regulation, mood regulation, and affect regulation are sometimes used interchangeably

and sometimes differentiated (Koole, 2009). This reflects that mood regulation, emotion regulation, and affect regulation are all constructs that are closely related (Koole, 2009). Koole (2009) described the empirical boundaries between these constructs as "fuzzy" (p. 7) and recommended using a broad definition of emotion regulation that encompasses emotion, mood, coping, and affect.

Physiological regulation can be defined as the conscious or unconscious strategies used to influence physiological (e.g., Autonomic Nervous System; ANS) arousal (Liew et al., 2011; McCraty & Childre, 2002). Measures of physiological arousal include Heart Rate Variability (HRV), Respiratory Sinus Arrythmia (RSA), heart rate, blood pressure, skin conductance, and respiration (Elliott & Edmonson, 2008; Liew et al., 2011; McCraty & Childre, 2002; Porges, 2007).

Self-regulation is defined as the integrative functioning of emotional and physiological regulation to maintain or reestablish homeostasis (Sbarra & Hazan, 2008).

Psychobiology is the biological study of psychophysiology (Diamond, 2001). Psychophysiology is the study of relationships between psychological and physiological processes as well as the related behavioral responses (Fox & Hane, 2008).

Brief Overview

This study is presented over five chapters. The first chapter provides an introduction to attachment and self-regulation as they relate to mental health. This chapter also includes a statement of the problem, the purpose of the study, the research questions, the need for the study, definition of key terms, and a brief overview of the manuscript. The second chapter includes a review of literature related to attachment,

emotion regulation, breathing, young adults, and concludes with an integrative summary. The methodology of the study comprises the third chapter, which includes the study research questions and hypotheses, a discussion of the participant selection and recruitment, study procedures, the variables assessed and the instruments that were used to measure them, and a discussion of the pilot study and resulting adjustments to the full study. Study data and results are presented in the fourth chapter. Finally, the manuscript ends with a discussion in chapter five of the conclusions to be drawn from study results. Chapter five also includes additional limitations, implications for practice, and suggestions for future research.

CHAPTER II

REVIEW OF RELEVANT LITERATURE

The statement of the problem, purpose, research questions, and the need for the study were presented in Chapter One. Additionally, Chapter One included definitions of key terms. In this chapter, literature relevant to the study of attachment, breathing, and emotion regulation among young adults is presented. Chapter Two includes the following sections: (a) Attachment Theory, (b) Emotion Regulation (c) Breathing (d) Young Adults, and (e) An Integrative Approach. The section on Attachment Theory includes an overview of the theory, discussion of the major tenets of the theory, the role of attachment in mental health issues, and a summary of the literature presented. An overview of emotion regulation literature is presented in the next section, including the role of emotion regulation in self-regulation, strategies of emotion regulation, emotion regulation and attachment, and a summary of this body of literature. The next section addresses breath-related literature and includes an overview of breathing and mental health, the hypothesized relationships between breathing and attachment, and a summary of the literature discussed. In this section, the literature on breathing and both emotional and physiological regulation is discussed in the context of healthy breathing, dysfunctional breathing, and mental health. The next section addresses the developmental needs of young adults, including who is considered a young adult, challenges to healthy development, and why this is the population of interest in the

current study. The final section in this chapter includes a summary of the empirical and conceptual relationships among these constructs and the relevance for mental health among young adults, providing an overview of why this study is relevant to explore previously unanswered questions.

Attachment Theory

Understanding and expanding Attachment Theory may be imperative to advancing knowledge of human development (Sroufe & Siegel, 2011) and effective mental health treatment (Schore & Schore, 2008). In fact, researchers have suggested that since its initial development, Attachment Theory may have had the largest impact on the fields of mental health and human development since the work of Sigmund Freud (Ainsworth, King, & Rayner, 1992), and Attachment Theory remains a "dominant approach" (Berghaus, 2011; Simonelli, Ray, & Pincus, 2004, p. 107). Beginning in the 1940's, over the course of more than 40 years, John Bowlby and Mary D. Salter Ainsworth worked both independently and collaboratively to develop Attachment Theory, a holistic theory of human development (Ainsworth & Bowlby, 1991). Building upon—and challenging—a foundation in psychoanalytic theory, they integrated a host of empirical and theoretical concepts from ethology, sociobiology, psychobiology, cybernetics, behavior theory, cognitive theory, and evolutionary biology (Ainsworth & Bowlby, 1991; Berghaus, 2011). Bowlby is credited with developing much of the theoretical underpinnings while Ainsworth contributed conceptually and furthered the theory through empirical studies, including assessment development (most notably the Strange Situation methodology) to test and refine the theory (Ainsworth & Bowlby,

1991; Bretherton, 1992). Attachment Theory is now understood as a holistic framework for conceptualizing and investigating the interaction of nature and nurture in human development (Schore & Schore, 2008), including psychobiological processes (Diamond & Fagundes, 2010; Dignam, Parry, & Berk, 2010; Schore & Schore, 2008). Specifically, Attachment Theory is used to address the impact of interpersonal and intrapersonal interaction on lifespan biopsychosocial development (Schore & Schore, 2008). Attachment related processes are thought to be essential to human evolution (Bowlby, 1982) and specifically to survival mechanisms (Zeifman, 2001). Among these processes, the role of attachment in the psychobiolgical development and maintenance of self-regulation systems is considered one of the most significant evolutionary tasks of the attachment system (Hart, 2011).

Though Attachment Theory was initially met with resistance (Ainsworth & Bowlby, 1991) and to some extent continues to be criticized (e.g., Kagan, 2011), Attachment Theory has steadily gained momentum and is now broadly studied and applied (e.g., Diamond & Fagundes, 2010; Main, 1996; Schore & Schore, 2008; Sroufe, 2005). Currently, Attachment Theory influences research across disciplines (Agostini et al., 2010; Brown et al., 2013; Flannelly & Galek, 2010; Martin, Paetzold, & Rholes, 2010; van IJzendoorn & Bakermans-Kranenburg, 2010; Wei, Liao, Ku, & Shaffer, 2011), mental health practice (Araneda, Santelices, & Farkas, 2010; Berlin, Zeanah, & Lieberman, 2008), and clinical supervision (Fitch, Pistole, & Gunn, 2010; Riggs & Bretz, 2006). Specifically, researchers in the fields of human development, psychophysiology, neuroscience, psychology, marriage and family therapy, counseling, social work, and

medicine have investigated and expanded the understanding of attachment theory and clinical implications (Ainsworth & Bowlby, 1991; Diamond & Fagundes, 2010; Mercer, 2011; Schore & Schore, 2008). Surprisingly, despite the developmental emphasis in counseling literature, over the past few decades there has been less attachment related research in the counseling field than related fields. Still, Attachment Theory appears to be gaining the attention of counselor researchers as evidenced by a recent surge in emprical and conceptual studies in the counseling literature addressing various aspects of attachment (Brown et al., 2013; Gnilka, Ashby, & Noble, 2013; Lynch, 2013). In order to understand the current state of the literature, future directions in Attachment Theory, relevance to mental health, and relationships with emotion regulation and breathing, it may be helpful to first discuss the formation and foundation of Attachment Theory. To begin, the following segment will highlight the pioneering work of John Bowlby and Mary D. S. Ainsworth in the development of Attachment Theory.

John Bowlby

John Bowlby (1907-1990) completed medical and psychiatric training with a focus on psychoanalysis and developmental psychology (Ainsworth et al., 1992; Bretherton, 1992) and went on to study child and adult psychopathology (Berghaus, 2011). Early in his career, Bowlby observed children at London's Tavistock Clinic (Berghaus, 2011). These observations inspired him to investigate childhood development beyond the psychoanalytic focus on children's fantasy lives to address the children's actual experiences in life (Ainsworth & Bowlby, 1991), including the generational transmission of behaviors and survival strategies (Bretherton, 1992). Based on his early

observations, Bowlby became convinced that human development is significantly impacted not only by early childhood internal experiences examined in the psychoanalytic tradition but also by external experiences not addressed by psychoanalysis at that time (Ainsworth & Bowlby, 1991). Bowlby suspected that infants become attached to caregivers not merely for the purpose of being fed but also to fulfill other needs including affection, closeness, and protection (Sroufe & Siegel, 2011). In 1948, Bowlby established a research team to begin investigating these ideas, beginning by observing children who were separated from their caregivers and living in either hospital or institutional settings (Bretherton, 1992).

In developing an ethological framework for human development, Bowlby was particularly inspired by Konrad Lorenz's work on imprinting (e.g., Lorenz, 1937), the use of observation in natural settings, and the work of both Robert Hinde and Harry Harlow (Harlow, 1953, 1958; Harlow & Zimmerman, 1959; Hinde, 1964). Bowlby was further inspired to read about evolutionary biology and systems theory. Drawing from these bodies of literature, Bowlby wrote several papers on an ethological approach to human psychological development (e.g., Bowlby, 1957, 1958). Bowlby furthered his understanding of proximity seeking and infant attachment through studying Harry Harlow's and Robert Hinde's research. Bowlby drew key connections between attachment, evolution, survival mechanisms, safety, grief, and loss (Ainsworth & Bowlby, 1991; Bowlby, 1982; Bretherton, 1992). Both individually and through collaborations with Ainsworth, Bowlby contributed formal presentations and publications on attachment theory beginning in the mid 1950's and continuing into the 1980's

(Berghaus, 2011). In 1969, Bowlby published the Attachment and Loss volumes, the first of which was *Attachment* (Bowlby, 1969, 1982). In *Attachment*, Bowlby described interrelated behavioral systems of infant attachment and adult caregiving behaviors, organization of internal working models, exploration behaviors, and the ontogeny of attachment (Bowlby, 1969/1982). The second volume, *Separation*, was published in 1973 (Bowlby, 1973). In *Separation*, Bowlby expanded on attachment processes related to separation anxiety, anger, fear, survival, insecure attachment, secure attachment, generational effects, and personality development. The third volume, *Loss*, was published in 1980 (Bowlby, 1980). In this volume, Bowlby expanded on child and adult vulnerability, grief, mourning, psychological defenses, and cognitive aspects of attachment processes.

Mary Ainsworth

Meanwhile, Mary Ainsworth (1913-1999) received training in developmental psychology and studied with several researchers including William Blatz, who developed a theory of security to increase understanding of human personality development (Ainsworth & Bowlby, 1991; Bretherton, 1992). Ainsworth was interested in the development of insecurity versus security, though she believed Blatz' security theory did not adequately address psychological defenses (Ainsworth & Bowlby, 1991). Fortuitously, Ainsworth came to work on Bowlby's research team at the Tavistock clinic in 1953 around the time that he was turning to ethological approaches in an effort to understand children's responses to separation (Ainsworth & Bowlby, 1991; Bretherton, 1992). Illustrating the novelty of integrating the ethological lens in the study of

psychology and human development at that time, Ainsworth described the shift to thinking in ethological terms as "a real paradigm shift. It was a sudden, total, and permanent change in perspective" (Ainsworth & Marvin, 1995, p. 7). One of the researchers on Bowlby's Tavistock team was James Roberson who completed extensive observation of children's response to separation and loss (e.g., Roberston, 1953). His work had a significant impact on Ainsworth and inspired her to use direct observation in her own research (Ainsworth & Marvin, 1995).

Ainsworth was able to take her "ethological thinking" to Africa where she investigated Bowlby's ideas empirically through direct observation in natural settings, beginning with observing mothers and their children in their homes in Uganda (Ainsworth, 1967; Ainsworth & Bowlby, 1991). Although much of her work in Uganda was not published until later (Ainsworth, 1967), Ainsworth's work in Uganda supported and expanded the conceptualization of mother, or primary caregiver, as secure base and safe haven as well as processes of secure and insecure attachment (Ainsworth & Bowlby, 1991). After returning to the United States, Ainsworth began a longitudinal study, the Baltimore Study, to further investigate these relationships (Ainsworth, 1964; Bretherton & Main, 2000). It was during the course of this study that Ainsworth first developed and conducted the strange situation assessment of mother-child attachment security (Ainsworth, 1964). Ainsworth's longitudinal work and strange situation assessment provided support for Attachment Theory, expanded understanding and empirical support for the differences between secure and insecure infant-mother attachment, subgroups of insecure attachment, and the importance of interactions between mother and infant

behaviors (Ainsworth & Bowlby, 1991). During this time, Ainsworth collaborated with Bowlby on many works (e.g., Bowlby & Ainsworth, 1965). Ainsworth also continued to expand Attachment Theory independently, including the cross-cultural relevance of attachment and extending the conceptualization and empirical support for attachment processes beyond caregiver/child relationships to other ages and relationships (e.g., Ainsworth, 1989).

Span of Attachment Theory Literature

Together, Bowlby and Ainsworth created a foundation for Attachment Theory that has been described as "eminently researchable" (Brandell, 2010, p. 132) and, accordingly, Attachment Theory has since been extensively tested and expanded. To illustrate the volume of related literature that has accumulated over the past 60 years, a search for "attachment theory" on worldcat.org, an online library catalog, yielded 35,802 peer reviewed articles, 2,348 theses/dissertations, and 4,751 books. Thus, the literature review presented in this chapter represents a relatively brief overview of Attachment Theory literature that is most relevant to the study and is not intended as a comprehensive discussion of the vast body of Attachment Theory literature. In the following sections, the most relevant aspects of Attachment Theory will be discussed, including theoretical underpinnings, evolution, survival, mammal development, attachment relationships, attachment behavioral system, and attachment styles.

A Theory of Lifespan Human Development

Bowlby and Ainsworth drew upon a fairly complex array of existing theories and disciplines in the development of Attachment theory (Ainsworth & Bowlby, 1991), a

trend that has continued among contemporary attachment researchers. It is beyond the scope of this chapter to explore each of these areas of study in depth. Nonetheless, the highlights thought to inform the early and ongoing development of attachment theory are presented. During both Bowlby and Ainsworth's early professional development, psychoanalytic theory and social learning theory were the dominant views on early human development, while ethology and evolutionary biology were emerging as essential to understanding animal behavior and the development of living systems.

Psychoanalytic theory and social learning theory. Psychoanalytic theory was particularly influential for both Bowlby and Ainsworth and continues to influence many attachment researchers (e.g., Brandell, 2010; Schore, 2007). Independently and collaboratively, Bowlby and Ainsworth extended, adapted, and challenged psychoanalytic concepts about lifespan development and the infant/child-caregiver relationships. For instance, the meaning of the term *attachmen*t was adapted from its occasional use in psychoanalysis to describe love relationships (Ainsworth, 1969). In an attempt to advance understanding of human development and make sense of their observations of children's need for proximity and affection from a primary caregiver, Bowlby and Ainsworth reviewed and often challenged the work of many of their peers and predecessors including Sigmund Freud, Anna Freud, Harry Stack Sullivan, Melanie Klein, Margaret Mahler, Erik Erikson, and Albert Bandura (e.g., Ainsworth, 1969; Ainsworth & Bowlby, 1991; Bowlby, 1953, 1969/1981). Specifically, at the time that Bowlby and Ainsworth were laying the groundwork for the development of attachment theory, researchers in both psychoanalytic theory and social learning theory argued that

the bond between infant and caregiver was based upon the infant's desire to be fed and the pleasure derived from satisfaction of the hunger drive (Cassidy, 2008). Reflecting back on the dominance of this view, Ainsworth remarked "the idea that infants' attachment could develop for any other reason was almost unheard of" (Ainsworth & Marvin, 1995, p. 6). Bowlby and Ainsworth saw this view as incongruent with their observations of children and their caretakers as well as their contemporaries' observations of both human (Roberston, 1953) and nonhuman (e.g., Harlow, 1953; Lorenz, 1937) infant/child-caregiver behavior. It is also important to note that their consideration of ethological research (initiated by Bowlby) was a radical departure from psychoanalytic and social learning theory, so much so that Ainsworth herself cautioned Bowlby that using Lorenz's work to support his arguments might damage his reputation in the academic community (Ainsworth & Marvin, 1995). They also challenged another key assumption of popular thinking at that time, the assumption that fear arises only in *high-risk* situations that are intrinsically painful, dangerous, or to which a person has learned, or been conditioned, to be afraid (Bowlby, 1981). Rather, Bowlby (1969/1982, 1981) asserted that fear arises not only in response to high-risk situations but also to those in which there is an *increased risk* of danger, such as the anticipation of separation or loss from an attachment figure.

Despite these significant departures, psychoanalysts' conceptualities of object relations and social learning theorists' ideas about dependency have been largely influential in the development of attachment theory (Ainsworth, 1969; Maunder & Hunter, 2001; Schore & Schore, 2008). In fact, there are many precepts of

psychoanalytic theory that remain intact in attachment theory. When reflecting on his attachment research in this context, Bowlby argued a case for psychoanalysis as a natural science (Bowlby, 1981). As such, it can be claimed that Attachment Theory fits under the umbrella of a 'psychodynamic approach' (Fonagy, Gergely, & Target, 2008). Illustrating this point, Fonagy et al. (2008) outlined nine shared assumptions of psychoanalytic and Attachment Theory:

1. *Psychological causation.* The individual's internal psychological experiences influence lifespan development.
2. *Formative nature of infant-caregiver relationship*. The early infant-caregiver relationships shape cognitive functions and personality development.
3. *Relevance of the unconscious*. Non-conscious internal experiences including expectations, beliefs, and fantasies shape emotion regulation and interpersonal behavior.
4. *Existence of internal representations of relationships*. Internal representations, or internal working models, of self-other relationships are thought to organize emotion regulation and interpersonal behavior.
5. *Psychological conflict and safety*. Psychological distress is caused by a lack of perceived safety and an experience of conflict between motivation, cognitions, and emotions.
6. *Psychological defenses*. Internal representations are often distorted in an attempt to reduce various forms of distress.

7. *Behavior complexity*. Behavior may be motivated by implicit internal experiences without conscious awareness of the individual.
8. *Therapeutic relationship*. Effective clinicians are supportive, respectful, and empathetic.
9. *Developmental*. Mental health problems have roots in developmental history and one of the primary purposes of intervention is to promote healthy development.

Building upon this foundation, Bowlby and Ainsworth drew on several bodies of literature and fields of study to further their understanding of human development and develop congruence between developmental theory and observations of human behavior. Reflecting this goal, one of their most significant contributions was viewing developmental psychology in the context of evolution and ethology.

Evolution, ethology and mammalian development. In light of evolutionary theory, Bowlby believed that all behavioral systems must be conceptualized within a framework that places "survival of the genes" as the "ultimate outcome" (Bowlby, 1969/1982, p. 56). Consequently, in order to inspire, inform, and test their research in human development, Bowlby and Ainsworth drew heavily on ethological literature and methodology. Simply put, ethology is the study of evolution and animal behavior ("Ethology," 2013). As mentioned previously, among these influences were Konrad Lorenz (e.g., Lorenz, 1937), Harry Harlow (e.g., Harlow, 1953, 1958), and both the work of and personal correspondence with Robert Hinde (e.g., Hinde, 1964). In a summary of Lorenz' (1937) work, Bowlby (1969/1982, p. 167) outlined the four characteristics of

imprinting (a process identified as avian attachment behavior in which an attachment bond is formed): "(1) that it takes place only during a brief critical period in the life-cycle, (2) that it is irreversible, (3) that it is supra-individual learning, and (4) that it influences patterns of behavior that have not yet developed in the organism's repertoire, e.g., the selection of a sexual partner." Later understanding of imprinting countered Lorenz's assertions of a critical period and irreversibility. Still, Bowlby argued that some of the principles of imprinting could be more broadly applied to the processes that influence attachment behavior, avian or mammalian, toward an attachment figure, offspring, or sexual/romantic partner (Bowlby, 1969/1982). Over the past sixty years, research on the attachment behavior of animals such as rats, mice, monkeys, and elephants have been particularly useful in understanding attachment in the context of lifespan development (e.g., Bradshaw & Schore, 2007; Harlow, 1953; Hinde, 1964; Maunder & Hunter, 2001).

Most famously, investigations led by Harlow (e.g., Harlow, 1958; Harlow & Zimmerman, 1958, 1959) and Hinde (e.g., Hinde, 1964) provided evidence that infant monkeys' need for affection is a primary drive. In his empirical and conceptual work, Harlow (1958) illustrated that, though hunger, thirst, pain, sex, and elimination of waste were commonly viewed as the primary drives of early mammal development, it is the need for love and affection that are primary drives (Harlow, 1958). Over the course of a 3-year study, more than 60 infant monkeys were separated from their mothers within 12 hours of their birth. The infant monkeys were typically provided with two 'surrogate mothers,' one made of wire and one made of soft cloth material. Either the wire or the

soft ‘mothers’ included a bottle for feeding the monkey yet in both cases the monkeys spent the majority of their time clinging to the cloth ‘mother.’ Monkeys also clung to soft cloth pads at the foot of the surrogate mothers. Though they were later socialized with other monkeys and their needs for food, water, sex, and elimination were provided for over the course of their development, with the absence of caregiver and peer relationships in early life, these monkeys later exhibited severe problems in development including bizarre behavior, aggression, confused sexual behavior, somatic symptoms, and either indifferent or abusive parenting of their offspring. In reviewing this work, Bowlby found support for his assertion that it is proximity and physical contact with an attachment figure rather than food supply that shapes and fulfills the infant’s primary developmental needs (Ainsworth & Bowlby, 1991). Harlow concluded that one of the chief functions of the primary caregiver is “to provide a haven of safety for the infant in times of fear and danger” (Harlow, 1958, p. 678). This work informed Bowlby and Ainsworth’s later conceptualization of attachment theory, including the attachment figure as fulfilling roles of *secure base* and *safe haven* (Ainsworth, 1964).

The bedrock of attachment theory is the assertion that mammalian attachment processes developed through evolution in order to accommodate survival needs in which it became necessary for mammals to familiarize and adapt to their environment in a more refined way than instincts alone had previously provided (Hart, 2011). Attachment processes, such as the *attachment behavioral system*, are thought to improve infants (both human and nonhuman) likelihood of survival while also allowing for more sophisticated development by utilizing the primary caregiver’s (i.e., the attachment figure) more

developed psychobiological systems (e.g., nervous system and social system) to support, organize, and shape the development of the infant's or child's immature systems (Berghaus, 2011; Hart, 2011). The primary role of the attachment behavior system is to promote survival of both the individual and the genes (Bowlby, 1969/1982). Accordingly, attachment processes promote development through facilitating the formation of self-regulation (Bretherton, 1992; Hart, 2011), teaching the developing infant/child when they are safe or unsafe, regulating their internal systems (physiological and psychological) accordingly, promoting survival skills within their environment including social interaction, managing physical challenges, and teaching the use and acquisition of tools, shelter, and food (Cassidy, 2008). To this end, proximity seeking is thought to be a fundamental attachment behavior (Cassidy, 2008). In fact, Bowlby (1969/1982, p. 195) defined attachment behavior as "seeking and maintaining proximity to another individual." When secure, the individual feels safely able to explore their environment freely and proceed with healthy psychobiological development, including adaptive long-term self-regulation strategies (Hart, 2011). When they learn that they are unsafe or insecure within their environment, the individual's short-term self-protective drives are activated which, in turn, activates the attachment system and motivates attachment behaviors (Bowlby, 1969/1982). When these attachment behaviors are ineffective or an individual learns from their caregiver/attachment figure's responses, behaviors, availability, and/or unavailability, that they are acutely and/or chronically threatened, they experience acute and/or chronic activation of the stress-response system, also known as fight-or-flight, in which short-term survival is prioritized over long-term

healthy development. When chronically activated, the stress response system undermines long term healthy development (Schore & Schore, 2008). The caregivers' response both to the environment and to the developing child—beginning in utero—informs the infant or child about their expectations of safety in their world (Thomson, 2007). As such, infants and children rely on their caregivers/attachment figures for their basic needs, protection, and, ultimately, development of adaptive or maladaptive survival strategies, including self-regulation (Calkins, 2004; Hart, 2011; Sroufe, 2005). Contrary to early assumptions about human development, researchers in both human and nonhuman attachment have found that affection is critical attachment behavior that is primary to this process (e.g., Ainsworth, 1969; Bowlby & Ainsworth, 1965; Harlow, 1958). This may reflect the absolute necessity of physiological and affective attunement in facilitating lifespan healthy development (Hart, 2011). Researchers have found that these attachment processes continue into adulthood as the primary attachment figure(s) shift from caregiver to romantic partner and/or close friend, and as the individual takes on the role of caregiver for their own offspring (Ainsworth, 1989; Ainsworth & Bowlby, 1991; Hart, 2011; Martin et al., 2010). Rather than an end in and of themselves, attachment relationships are a system through which evolutionarily essential tasks are prioritized and executed (Hart, 2011). The human attachment system is considered a highly complex system (Ainsworth & Bell, 1970; Hart, 2011) that shapes emotional, cognitive, social, spiritual, and physiological systems over the course of both lifespan and generational development. The following section the main tenets of attachment theory, including

attachment relationships, attachment behavioral system, style, and attachment figure are described.

Attachment relationships. Attachment is inherently relational. Accordingly, attachment relationships are the primary focus of attachment conceptualization and research. Attachment relationships are those in which an attachment bond has been established with a specific identifiable other. Ainsworth (1964) outlined five implications of the attachment relationship:

1. Affection is inherent in attachment relationships,
2. Attachment relationships are specific,
3. Attachment requires action including but not limited to observable behavior,
4. Attachment is an active process,
5. Attachment is a bi-directional process requiring two-way interaction.

The individual or object with whom this attachment bond is established is known as the *attachment figure* (Bretherton, 1992). In early life, the attachment figure(s) is typically the primary caregiver(s) while in later life the attachment figure(s) is typically a romantic partner or a close friend (Main, 1996). Researchers have suggested that a person's most important task as an infant is to create a secure attachment bond with a primary caregiver (Schore & Schore, 2008). The necessity of this bond is illustrated by the role of the early attachment figure in acting as a co-regulator of developing physiological and emotional regulation systems that are initially regulated externally in this way (Calkins, 2004). In fact, researchers have suggested that adaptive self-regulation can only be achieved after the critical developmental accomplishment of effective co-

regulation in early life (Diamond & Aspinwall, 2003). In other words, when a secure attachment exists in an attachment relationship the attachment figure is able to effectively provide the safety and security needed for the individual to adaptively regulate their internal systems (Butner et al., 2007; Calkins, 2004) in order to effectively explore their world, including environmental and social relationships (Flannelly & Galek, 2010). As such, the attachment figure acts as a secure base and a safe haven (Ainsworth & Bowlby, 1991; Bretherton, 1992). When the attachment behavior system is activated, the individual seeks a *safe haven* of safety, comfort and reassurance from the attachment figure (Ainsworth & Bowlby, 1991; Cassidy, 2008). In infancy, childhood, and adulthood, the attachment figure provides a safe haven by effectively responding to the individual's communication. When the attachment behavior system is not activated, the secure individual feels safe to explore their world. In other words, the exploratory system is activated (Bowlby, 1982; Cassidy, 2008). In this case, the attachment figure acts as a *secure base* from which the individual is able to launch exploration and learning processes (Ainsworth & Bowlby, 1991). In adulthood, the attachment figure acts as a secure base through supporting the individuals "personal growth and exploration activities" (Feeney, 2008, p. 472). As the individual develops, proximity may be physical and/or psychological (Pistole & Fitch, 2008). For instance, psychological proximity may be attained in childhood or adulthood through a phone call, email, or even envisioning reassuring contact with the attachment figure (Pistole & Fitch, 2008). In early development, the attachment figure utilizes a variety of conscious and non-conscious communication to shape the developing individual's adaptation to a safe or threatening

world and self-regulation (Calkins, 2004; Schore & Schore, 2008). Similarly, adult attachment figures, such as romantic partners, also develop patterns of conscious and non-conscious communication and co-regulation (Butner et al., 2007). Naturally, these patterns of co-regulation in adult attachment relationships are more reciprocal in care-giving than early childhood relationships (Mikulincer et al., 2003). In studies investigating emotional regulation and co-regulation in adult romantic attachment, researchers reported that, among securely attached adults, attachment figures may be better able to maintain physiological and emotional homeostasis while their partner experiences distress and, in turn, the distressed partner may be able to more quickly deescalate distress, or effectively self-regulate (Butner et al., 2007; Diamond, 2005). In this way, the couple engages in effective co-regulation in which the attachment figure functions as an effective safe haven evidenced by adaptive emotional and physiological regulation of both adults. Conversely, among insecurely attached adults, attachment figures may experience greater distress (either physiologically and/or emotionally) in response to the distress of their partner and, thus, the distress of the attachment figure may escalate or maintain the physiological and emotional distress of their partner, reflecting maladaptive self-regulation strategies (Butner et al., 2007; Schneiderman et al., 2011). Understanding the role of the attachment figure(s) and both the formation and maintenance of self-regulation in the attachment behavioral system is essential to understanding the operations of the attachment system and the lifespan impact of attachment relationships that are relevant to mental health treatment.

Attachment behavioral system. The conceptualization of the attachment behavioral system illustrates the influence of behavior, control, and systems theories on the formation of attachment theory and further demonstrates the importance of the attachment figure. One of the most important tenets of attachment theory is that behavior has a biological basis that is organized by the attachment behavioral system (Cassidy, 2008). As described above, adaptive attachment behaviors typically are thought to be behaviors that reduce perceived or actual danger through increased physical or psychological proximity to a specific person, the attachment figure (Bowlby, 1982; Cassidy, 2008). For example, smiling, reaching, clinging, and crying can function as observable attachment behaviors (Ainsworth & Bell, 1970; Bowlby, 1982). The attachment behavioral system is the organization of these behaviors to accomplish a particular goal. Further, the reciprocal attachment behavior of the attachment figure also is fulfilled through internal organization of the behavior system (Cassidy, 2008). In the context of evolution and lifespan development, this goal includes both survival and healthy development. Bowlby (1982, p. 374) agreed with Bretherton that this system also could be described as a "safety regulating system" with the primary function of safety and survival through self-regulation processes.

A key assumption in the conceptualization of the attachment behavioral system is that the individual's history of internal and external experiences shapes the organization of specific attachment behaviors into response patterns (Cassidy, 2008). Bowlby described two types of experiences that primarily influence this organization and thus the activation of the attachment behavior system: indications of possible danger or stress, and

accessibility of attachment figure (Bowlby, 1982). Additionally, the attachment behavior system may be activated by basic internal needs such as hunger or physical illness (Feeney, 2008). It is important to note that it is not the trigger (e.g., proximity, danger) itself but rather the individual's perception of the trigger that can serve to activate or deactivate the attachment behavior system (Koback & Madsen, 2008). In other words, it is the perception of safety that modulates distress and, accordingly, the attachment behavior system. Thus, across the lifespan the attachment behavior system is most commonly activated by perception of possible danger, stress, separation or anticipated separation from the attachment figure (Bowlby, 1982; Feeney, 2008).

Reflecting the role of attachment in self-regulation, researchers have found that the organization of the attachment behavior system also is related to the organization of both physiological and emotion regulation. The organization of the attachment behavioral system is thought to be heavily influenced by physiological experiences (Fonagy & Target, 1997). The organization is internalized into expectations of self, others, and the world (Fonagy & Target, 1997), often described as internal working models (Feeney, 2008). These internal working models are then manifest in the individual's attachment style (Collins, 1996). Further, in understanding the attachment behavior system, attachment cannot be accurately described in terms of degree, as in one is more or less attached (Main, 1996). Although the strength of particular attachment behaviors vary, the strength of attachment itself does not appear to vary, at least not in a measurable way (Ainsworth & Bell, 1970). Rather, it is typically the organization of attachment behaviors, as seen in attachment style, which differs from individual to

individual. In fact, early attachment figures are established within the first months of age and nearly all infants become attached regardless of the quality and availability of the attachment figure's caregiving (Main, 1996).

When the attachment behavioral system is activated, the individual uses attachment behaviors to alleviate physiological and emotional distress in an attempt to reinstate safety and physiological and/or psychological proximity to the attachment figure (Bowlby, 1982; Cassidy, 2008). A variety of behaviors can be organized to serve a particular attachment related function. Although the specific behaviors used within the system may change over the course of lifespan development, this internal organization is usually stable (Cassidy, 2008). The responses of the attachment figure greatly influence the individual's distress as well as the organization and reorganization of the attachment behavior system (Main, 1996). Thus, the adaptive attachment behavioral system promotes flexible adaptation to the changing demands of the individual's environment and relationships (Bowlby, 1982). Of course, it is not possible to directly observe all of the multifaceted processes of attachment such as the many contributing factors to the organization of attachment behaviors. Since Ainsworth's early observations (e.g., Ainsworth, 1967; Ainsworth & Bell, 1970), however, researchers have found that the study of attachment styles (thought to be an observable attachment phenomena reflecting the organization of the attachment behavior system) is imperative in investigating attachment relationships (Ainsworth, 1964).

Attachment styles. Individuals' attachment style and, thus, the pattern of perception and responses in which they relate to self, other, and their world, is formed

through an intricate interaction between the individual's genetic/biological predisposition, their environment, and their interactions with their attachment figure (Schore & Schore, 2008; Steele, Steele, & Croft, 2008). Understanding of attachment styles first emerged through Ainworth's development of the Strange Situation assessment (Ainsworth, 1964; Ainsworth & Bell, 1970; Bretherton, 1992). Initially, Ainsworth developed the Strange Situation methodology to investigate the balance of infant attachment and exploratory behaviors in low or high stress situations (Bretherton, 1992). Specifically, the Strange Situation was intended to provide an opportunity to observe how strange circumstances, separation, and reunification with an attachment figure impacts the infant's or child's attachment behavior and exploratory systems (Ainsworth & Bell, 1970). The Strange Situation is a multi-part situational observation of infant or child responses to a strange environment, a stranger, and separation and reunion with the attachment figure (Ainsworth & Bell, 1970; Bretherton, 1992). Though there are some variations, typically the Strange Situation begins with the infant and caregiver together in a playroom equipped for non-invasive observation. Next the observer watches how the infant responds when a stranger enters the playroom. In the third scenario, the stranger plays with the infant. The caregiver then leaves the room. The stranger leaves the room when the caregiver returns. Next, the caregiver leaves the playroom (at this point the infant or child is alone in the play room). Next, the stranger returns to the room. Finally, the caregiver returns to the room. Researchers carefully observe the infant or child and caregiver responses and behaviors throughout each scenario and the transitions between.

During early observations in the Strange Situation, Ainsworth and her colleagues observed unexpected patterns of behavior upon reunification with the attachment figure (Ainsworth & Bell, 1970; Bretherton, 1992). For instance, though most infants engaged in proximity seeking behaviors during separation (e.g., crying), infant behavior varied upon reunification. Although some infants sought and readily received reassurance from the caregiver, other infants exhibited ambivalent or avoidant behavior toward the caregiver (Ainsworth & Bell, 1970; Bretherton, 1992; Main, 1996). These patterns became known as the Strange Situation Categorization and later became known as attachment styles (Main, 1996). Initially, Ainsworth, Blehar, Waters, and Wall (1978) identified three categories of attachment styles seen in the Strange Situation methodology. Main (1996) later identified a fourth category using the Strange Situation methodology, category D. Each of the four categories are summarized below. Category B represents the secure attachment style, Categories A and C reflect organized insecure attachment styles, and category D is the disorganized insecure attachment style:

1. Category A (Avoidant Attachment): These infants lack emotional expression, do not cry upon separation, and actively ignore the caregiver upon reunification.
2. Category B (Secure Attachment): These infants express missing their caregiver during separation. They then seek reassurance from the caregiver upon reunification, and then after brief contact they resume exploratory behaviors.

3. Category C (Anxious/ambivalent Attachment): These infants appear preoccupied with their caregiver throughout play, separation, and reunion. Upon reunion they may exhibit passivity, seek or resist the parent. They do not resume exploratory behaviors, instead, this individual maintains focus on the caregiver and may exhibit anger or tearfulness.
4. Category D (Disorganized/Disoriented Attachment): These infants may exhibit behaviors of category A, B, or C while also exhibiting disoriented or seemingly contrary behaviors. For instance, rising upon reunification then sitting prior to gaining contact, or clinging to the caregiver while also leaning away.

Though initially these categories were studied exclusively in infant or child and caregiver relationships, over the past few decades researchers have extensively investigated adult attachment styles and the measurement thereof (e.g., Brennan, Clark, & Shaver, 1998; Fraley, Waller, & Brennan, 2000; Hazan & Shaver, 1987; Main, 1996). In advancing understanding of adult attachment styles, researchers have most commonly looked at adult romantic relationships, including both married and non-married relationships. Researchers have long espoused conceptual support for the suggestion that infant and childhood attachment relationships later influenced adult attachment relationships and that internal working models developed in childhood would have a persisting impact in adulthood. It was not until studies of adult attachment styles by researchers such as Hazan and Shaver (1987), however, that there was empirical support for adult romantic relationships as attachment relationships (Feeney, 2008; Hazan &

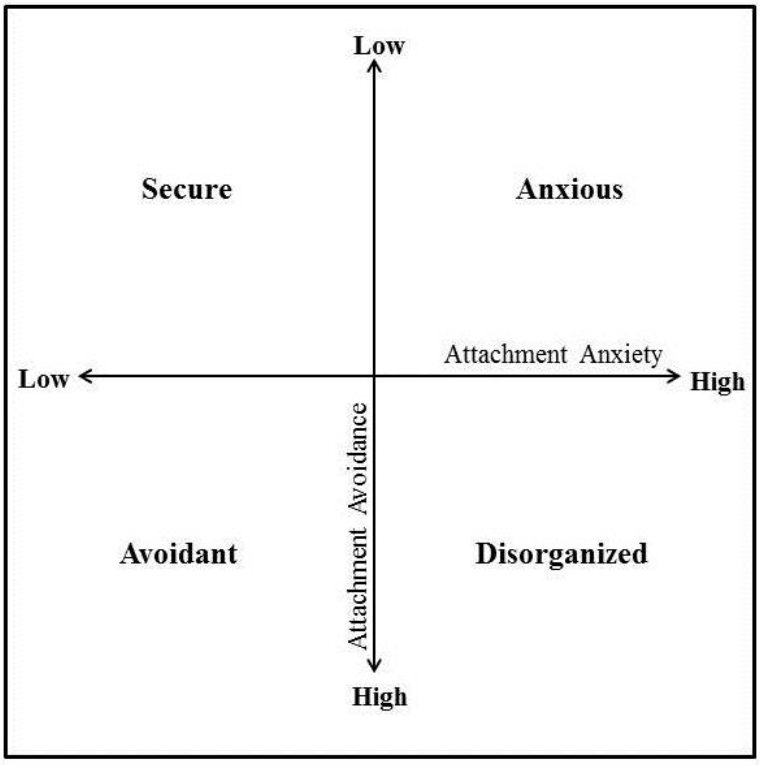
Shaver, 1987). The development of the measurement of adult romantic attachment style was essential to this shift. Measurement of adult romantic attachment style was first conducted through categorical selection (Bartholomew & Horowitz, 1991; Hazan & Shaver, 1987), qualitative interview (Adult Attachment Interview; Bakermans-Kranenburg & van IJzendoorn, 2009; Main, 1996), and, more recently, by quantitative self-report measures of attachment dimensions (e.g., Brennan et al., 1998; Fraley et al., 2000). This latter dimensional approach has been broadly validated and extensively used in quantitative investigations into adult romantic attachment (Fairchild & Finney, 2006).

Adult attachment dimensions. Though there continues to be some variance in the terms used to describe adult attachment styles, the characteristics of these categories are largely consistent and there is growing consensus that attachment styles, or strategies, include tendencies in two dimensions of attachment anxiety and attachment avoidance (e.g., Brennan et al., 1998; Fraley et al., 2000). Although categorical approaches to adult attachment measurement are recommended for clinical use and may be relevant in some research, dimensional approaches are recommended for research due to greater sensitivity to subtle differences between subjects (Ravitz, Maunder, Hunter, Sthankiya, & Lancee, 2010). Incidentally, some dimensional measures of attachment such as the Experiences in Close Relationships-Revised (ECR-R) yield data that can be used dimensionally or categorically. The relationships between the dimensions of attachment avoidance and attachment anxiety reflect the categories of attachment styles (see Figure 1). For instance, secure attachment can be characterized as a combination of low attachment anxiety and low attachment avoidance. Reflecting the descriptions of attachment

categories of insecure attachment identified by Ainsworth (1978) and Main (1996), insecure attachment styles may be characterized as anxious, evidenced by low attachment avoidance and high attachment anxiety; avoidant, evidenced by low attachment anxiety and high attachment avoidance; or disorganized, as seen in individuals who exhibit high attachment anxiety as well as high attachment avoidance.

Figure 1

Relationships Between Attachment Dimensions and Attachment Styles



Attachment Style and Self-Regulation. Like the development of attachment styles, researchers believe that self-regulation is developed through an integrated interaction of nature and nurture. The role of attachment in the development and maintenance of self-

regulation may reflect the key link between attachment and mental health. Secure attachment is evidenced by successful self-regulation in individuals who feel safe to explore their world, including survival, social, and learning experiences (Ainsworth & Bowlby, 1991; Schore & Schore, 2008). In early secure attachment relationships, caregivers respond consistently, sensitively, and appropriately to infant communications and both positive and negative states (Ainsworth & Bowlby, 1991; Schore & Schore, 2008). This effective attachment communication is evidenced, in part, by the development of effective emotion-regulation. The soothing behaviors of the attachment figure are internalized into self-soothing behaviors as a means of self-regulation (Mikulincer & Shaver, 2007). Researchers have asserted that securely attached infants are better equipped to remain effective in their self-regulation during exposure to negative emotion (Weinfield, Sroute, Egeland, & Carlson, 2008). It is also expected that attachment figure(s) in securely attached dyads are able to effectively self-regulate and adapt to a broad range of emotional experiences (Weinfield et al., 2008). Additionally, researchers have asserted that securely attached dyads experience more effective attunement as evidenced by greater synchrony in physiological systems and accurate interpretation and communication of affect (Diamond & Fagundes, 2010; Fox & Hane, 2008; Schore & Schore, 2008).

To the contrary, insecure attachment is thought to foster maladaptive physiological and emotional-regulation, as seen in individuals who, to varying degrees, do not feel safe to explore their world (Calkins, 2004; Diamond & Fagundes, 2010). This lack of perceived safety and inability to effectively self-regulate is thought to result in

increased susceptibility to mental health issues in child and adulthood (Simonelli et al., 2004). Accordingly, individuals who experience insecure attachment styles report greater symptoms of mental health issues (Cooley & Garcia, 2012), including anxiety (e.g., Simonelli et al., 2004), depression (e.g., Simonelli et al., 2004; Wei, Russell, Mallinckrodt, & Zakalik, 2004) and, more broadly, stress (e.g., Kemp & Neimeyer, 1999) than do their securely attached counterparts. Organized insecure attachment (i.e., anxious or avoidant) is thought to be developed by caregivers who are not physically rejecting but do exhibit inconsistency and have difficulty emotionally and physiologically attuning with the infant (Main, 1996; Schore & Schore, 2008). For instance, researchers have suggested that due to emotionally rejecting caregivers, avoidantly attached individuals experience difficulty regulating emotion evidenced by minimization of direct communication of emotion, particularly distress. Illustrating this, the Strange Situation research (Ainsworth et al., 1978; Bretherton, 1992) indicates avoidant attachment style in infants is evidenced by unemotional behavior including lack of crying upon separation from caregiver, ignoring of caregiver upon reunion, and physically moving or leaning away from caregiver (Main, 1996). Avoidant attachment style in adults is evidenced by dismissive behavior including denying the impact of negative experiences (Main, 1996; Wei, Russell, Mallinckrodt, & Vogel, 2007).

Conversely, anxiously attached individuals are thought to communicate extreme emotion, especially distress, reflecting that attachment figures in these dyads typically respond predictably to large displays of emotion and erratically to more nuanced communication of affect (Weinfield et al., 2008). Infants who experience an anxious

style of attachment exhibit preoccupation with the attachment figure throughout the Strange Situation, alternate between seeking and resisting the caregiver, are often tearful, and may exhibit passivity or aggression (Ainsworth et al., 1978; Main, 1996; Wei et al., 2007). Adults who experience anxious attachment exhibit preoccupation with experiences, act with aggression or passivity, and typically display confusion, fear, and feelings of being overwhelmed when distressed.

Researchers have reported that disorganized attachment is most commonly developed through abuse and/or neglect by an attachment figure (Schore, 2001). In the case of abuse, the caregiver is either directly abusive or fails to provide protection from abusers of the infant/child (Bretherton, 1992; Main, 1996; Schore, 2001). Disorganized attachment is thought to reflect a "breakdown in attachment strategies" (Weinfield et al., 2008, p. 84). Individuals who experience disorganized attachment exhibit a lack of predictable emotion regulation strategies, increased physiological reactivity, and impaired neurological development (Schore, 2001b). Attachment figures in these dyads report difficulty caregiving, use of harsh discipline, and feelings of being "out of control" (Schore, 2001, p. 217). In addition to mental health issues associated with other types of insecure attachment, the powerful inability to develop coping and emotion regulation associated with the disorganized attachment style has been linked with a predisposition toward posttraumatic stress disorder and dissociation (Schore, 2001; Schore & Schore, 2008). One of the most promising tenets of attachment theory is that these attachment styles may be plastic, reflected in individuals' ability to (in varying degrees) develop

adaptive attachment behaviors and self-regulation strategies despite early experiences of insecure attachment and maladaptive self-regulation.

Plasticity of attachment style. Although scholars have long discussed the question of whether early attachment styles could be changed and, if so, what mechanisms might occasion this change, there has been surprisingly little empirical study of changes within adult attachment style. Rather, researchers have more frequently focused on relationships between childhood attachment style and adulthood attachment style (e.g., Sroufe, 2005). Nonetheless, some researchers have investigated differences between adult attachment style across relationships (e.g., La Guardia, Ryan, Couchman, & Deci, 2000), in response to life changes (e.g., Lopez & Gormley, 2002), and changes in attachment style in response to therapeutic intervention (e.g., Travis, Bliwise, Binder, & Horne-moyer, 2001). There is preliminary support that therapeutic intervention may facilitate increases in attachment security. Corrective experiences such as therapeutic intervention involve the repatterning of the distressed default to a new default of health. These processes are cumulative and overtly or covertly allow the individual to replace habitual maladaptive responses with adaptive responses (McCraty & Childre, 2002). For instance, Travis et al. (2001) conducted a study to investigate changes in attachment style among clients receiving out-patient mental health treatment for significant interpersonal issues (n = 80). Each client received short-term treatment (5 or more sessions) from either a psychologist or psychiatrist. Pre-post measures of attachment style were analyzed and globally the sample increased level of attachment security with a significant portion of the sample having changed from an insecure to secure attachment style.

Conversely, however, Strauss et al. (2011) investigated changes in attachment style among clients with personality disorders receiving inpatient mental health care in a 7-week program in Germany (n = 55) and reported no significant changes in a pre-post measure of attachment style. There are several considerations regarding these contrary results. First, it is congruent with the literature that individuals with more severe mental health symptoms may also experience greater attachment insecurity and, accordingly, change may be more difficult than for individuals with more highly functioning attachment and self-regulation strategies. Additionally, rather than a self-report measure of the four attachment styles, Strauss et al. (2011) conducted pre-post subjective interviews categorizing individuals into 7 possible styles, one secure, three varieties of anxious, and three varieties of avoidant. Therefore, measurement differences between the two studies may account for different findings. Further research is needed to evaluate how, why, when, and for whom attachment style changes. This is particularly salient in light of the fact that preliminary investigations indicate that attachment style may be related to therapeutic progress in mental health treatment (Travis et al., 2001).

Attachment style and attachment figure context. Although some researchers have reported that attachment style may be a trait-like predisposition, attachment style appears to be relationship-specific (Mikulincer & Shaver, 2007). This may reflect the differences in context-specific attachment relationships beginning in childhood. For instance, although there is typically one primary caregiver in infancy, over the course of childhood an individual may establish attachment bonds with other family members or other individuals such as a friend, teacher, coach, or counselor, depending on their contextual

needs and the availability of attachment figures. Accordingly, the individual's adult patterns may reflect this with variance in adulthood attachment style by attachment relationship (La Guardia et al., 2000).

From this, there is debate about the context in which true attachment bonds are formed. Some researchers have argued that true attachment bonds are only formed with a primary caregiver or romantic partner while others have suggested that true attachment bonds may exist in other relationships such as a friendship (La Guardia et al., 2000). Still, in young adulthood the bond between romantic partners may best reflect the biological necessity of attachment relationships toward the ultimate goal of "survival of the genes" (Bowlby, 1969/1982, p. 56). Thus, romantic attachment may be the most likely estimate of attachment style to the primary attachment figure in young adulthood. In keeping with the biological foundation of attachment theory, the psychobiology of attachment has emerged as a growing focus area in contemporary attachment theory research.

Psychobiology of attachment. The conceptualization of the attachment behavior system as a safety regulating system is particularly meaningful in the context of the psychobiology of attachment, physiological regulation, and the role of attachment processes in the stress response. As such, in examining mind-body-spirit relationships and the psychobiology of attachment, it is helpful to understand the physiology of the stress-response and self-regulation.

Stress response and self-regulation. Researchers have suggested that attachment is "inextricably tied to the experience of stress" (Kemp & Neimeyer, 1999, p. 388). The

stress-response system is a complex network of physiological responses that involves the nervous, cardiovascular, respiratory, endocrine, and immune systems (McCraty & Childre, 2002; Selhub, 2007) and plays a key role in manifestation of both physiological and psychological health issues (Elliott & Edmonson, 2008). The stress-response, also described as the fight-or-flight response, prepares the body to combat or avoid perceived danger (Chow & Tsang, 2007) such as triggers that activate the attachment behavior system. The acute stress-response includes the same series of events regardless of the trigger. In other words, the body's acute response is the same whether we are triggered by stressors of daily living (i.e., hunger) or a life threatening experience (i.e., car accident). The body responds to a stressful stimulus (perceived or anticipated threat) through shifts in the autonomic nervous system (ANS). The parasympathetic activity is suppressed while the sympathetic nervous system is activated (Crawford, 2010). This results in the fight-or-flight responses including but not limited to increased heart rate; increased glucose in the blood; decreased blood flow to some vital organs; increased respiration rate; the release of hormones such as adrenaline, noradrenaline, and norepinephrine; and limited function of key systems including immune, reproduction, and digestion (Chow & Tsang, 2007; McCraty & Childre, 2002; Selhub, 2007; Wargo, 2007).

When the stress response is infrequent, the body is able to quickly and efficiently return to normal functioning once the perceived threat is resolved. When the stress-response is chronic, however, the body is no longer able to regulate stress efficiently or return to healthy functioning effectively. Further, stress can form a vicious cycle wherein

the side effects of the stress response may cause further stress. When the stress-response system is dysregulated, growth, endocrine, metabolic, cardiovascular, respiratory, neurological, and/or behavioral functioning is chronically impaired. Consequently, chronic sympathetic activation (i.e., chronic stress, maladaptive self-regulation, dysregulation) results in a host of negative psychological and physical health symptoms. Insecure attachment also has been linked with chronic sympathetic activation (Diamond, Hicks, & Otter-Henderson, 2006; Maunder et al., 2006). In addition to other physiological markers, chronic sympathetic activation is evidenced by an unhealthy breath pattern (Elliott & Edmonson, 2008). Conversely, adaptive self-regulation promotes the relaxation-response and thus fosters health and well-being (Selhub, 2007). The effective relaxation-response system supports healthy functioning of growth, endocrine, metabolic, cardiovascular, respiratory, neurological, and/or behavioral systems.

Conceptualizing the attachment behavior and exploratory systems in terms of the stress-response and relaxation response, ANS functioning offers key insights into the psychobiology of attachment. When the stress-response is triggered, the individual consciously or non-consciously engages in emotional and/or physiological self-soothing strategies internalized from experiences with attachment figure(s). The attachment behavior system may be activated when the stress-response system is activated and the individual is unable to effectively self-soothe. In an adaptive and effective attachment relationship, the attachment figure co-regulates this stress-response and the individual learns to reestablish safety and effectively down regulate the stress-response to resume a relaxation response and healthy long-term physiological and emotional regulation.

Attachment communication and, specifically, attunement are thought to be critical to the development of both these co-regulation and self-regulation processes.

***Attachment communication*.** Communication between an individual and the attachment figure, including social, survival, and safety cues, is critical to attachment processes (Schore & Schore, 2008). Attachment communication takes many forms and may be conscious or non-conscious, verbal or non-verbal. Attachment communication plays a critical role in the organization of the attachment behavior system, the development of attachment styles, and the formation of physiological and emotional regulation (Feldman, 2007; Schore & Schore, 2008). Though individuals are most readily aware of conscious communication, both non-verbal and verbal, non-verbal non-conscious communication may be among the most influential forms of attachment communication. Specifically, the psychobiological processes of attunement play critical roles in attachment related communication (Schore, 2001a) and are crucial in the study of the psychobiology of attachment.

Attachment, self-regulation, and attunement. Researchers have suggested that attachment communication involves non-conscious bodily-based "psychobiological transactions" (Schore, 2000, p. 38) between an individual and attachment figure that facilitate adaptive or maladaptive regulation and the development of attachment style. Bowlby (1982) suggested that these non-conscious communications include audible, visual, and physiological factors, including facial expression and tone of voice. Advancement in technology has allowed researchers to see that attachment related processes also include physiological processes including but not limited to neurological

development (Coan, 2010; Schore & Schore, 2008), heart rate (e.g., Zelenko et al., 2005), and vagal tone (e.g., Diamond & Fagundes, 2010). These psychobiological transactions are thought to be critical to development, maintenance, and adaptation of conscious and non-conscious self-regulation strategies in both childhood and adulthood (Calkins, 2004; Diamond & Aspinwall, 2003; Diamond & Fagundes, 2010; Schore & Schore, 2008).

Mirroring the primary processes of self-regulation (emotion and physiological regulation), attunement includes processes of both emotional and physiological systems. In fact, researchers have asserted that attuned communication is critical to the development of adaptive self-regulation (Lamagna, 2011). Though the definition and terms related to attunement have not been consistently defined, most use terms such as attunement or synchrony to refer to the integrated functioning of affect and physiology in communication (e.g., Schore & Schore, 2008), while others specify these terms to describe their discrete functioning (e.g., Butner et al., 2007). For the purposes of this study, attunement can be defined as the process of synchronous conscious and non-conscious psychobiological transactions in interpersonal communication. Attachment communication processes influence and are influenced by physiological processes (Fox & Hane, 2008), and there is an essential regulation process that reflects a psychobiological connection between individuals in intimate and care-giving relationships (Diamond & Aspinwall, 2003). For instance, researchers have reported that when an individual is observing emotion, the observer begins to experience the same emotional feeling and related ANS arousal of the person being observed (Dickerson Peck, 2003). Early attachment experiences have been shown to shape later differences in

individual physiological and emotional responses (i.e., self-regulation) to stressors in both human and animal research (Fox & Hane, 2008), and psychobiological attunement may be a key factor in this process. Illustrating the powerful impact of attunement or misattunement, prolonged negative emotional states caused by a misattuned, unavailable, or abusive attachment figure change the biochemistry of the developing infant's brain, particularly in the areas that are associated with sense of self, self-in-relation, and emotion regulation (Schore, 2000; Schore & Schore, 2008).

In order to help the infant establish a secure attachment, the primary caregiver—the attachment figure—must use emotionally engaged/affective communications to attune to the infant. Attunement involves the recognition (consciously and non-consciously) of the internal states of the infant's central nervous system (CNS) and autonomic nervous system (ANS) and helps the infant experience an adaptive internal homeostasis, thus developing "emotional intelligence" and self-regulation (Schore & Schore, 2008; Steele, Steele, & Croft, 2008). In this way, the synchronized/attuned caregiver-infant interaction facilitates the development of adaptive self-regulation and the postnatal development of the infant's CNS and ANS (Schore & Schore, 2008). The infant's internal systems synchronize with the caregiver, in effect regulating these systems or, in the case of insecure attachment, dysregulating these systems. For example, in disorganized dyads the caregiver facilitates extreme levels (too high in the case of abuse and too low in the case of neglect) of CNS and ANS stimulation and arousal (Schore, 2001; Schore & Schore, 2008). The caregiver creates relational trauma, also described as an attachment injury, in their failure to re-attune to the infant to regulate these extreme states, instead allowing the

infant/child's negative states to persist over long durations of time (Coan, 2010; Schore, 2001; Schore & Schore, 2008). Neuroscience and attachment researchers have indicated that these prolonged negative states caused by the absence of effective attunement and the resulting relational trauma dramatically change the biochemistry of an infant's brain, particularly in the areas that are associated with sense of self, self-in-relation, coping skill development and emotion regulation (Coan, 2010; Schore, 2001; Schore & Schore, 2008).

Caregiver-infant engagement promotes attachment and is considered an effectively attuned, or synchronized, interaction when the caregiver attunes well with the infant during interaction, allows the infant to "quietly recover" when the caregiver is not engaged, and attends to infant's cues for reengagement (Ainsworth & Bowlby, 1991; Schore & Schore, 2008). Attunement nurtures the development of positive states in both infant and caregiver. When a caregiver "mis-attunes" (misunderstands or is unresponsive to infant arousal), they can then moderate the infant's negative state by recognizing the dissonance and "re-attuning" to the infant (Schore & Schore, 2008; Weinfield et al., 2008). These two phenomena of synchrony (which helps the infant experience positive arousal states) and re-attunement (which helps the infant moderate negative arousal states) are the building blocks of attachment, resilience, stress-response skills, self-regulation, and secure attachment (Schore & Schore, 2008; Steele et al., 2008). As the infant develops physiologically, including the neurological, cardiac, and respiratory systems, her or his adaptive abilities increase as self-regulation develops and improves (Schore & Schore, 2008). The successful development of this adaptability allows for the

individual to experience flexible self-regulation in relationship to self, others, and, later in life, to her or his environment (Diamond & Aspinwall, 2003). Accordingly, attachment experiences are critical in life-span development. The attachment processes within the caregiver-infant relationship and attachment generates and organizes lifespan holistic development, including physiological, behavioral, affective, and cognitive development (Coan, 2010; Diamond & Fagundes, 2010; Schore & Schore, 2008; Steele et al., 2008). It is important to note that in addition to early experiences of attachment injury, the threat to sense-of-safety, self-regulation, and/or sense of self, others, or world, may result in attachment injury at later stages of development (Main, 1996; Schore, 2001). For instance, an individual with previous patterns of secure attachment may experience an attachment injury via a range of experiences including but not limited to real or anticipated death of a loved one, exposure to war, career loss, divorce, infidelity, physical illness or injury, or a natural disaster, that causes a regression in emotional development, injures internal working models related to safety and self-in-relation and, accordingly, changes patterns of relating from security to insecurity (Schore, 2009a). In the case of relational trauma, the injury also may be described as an absence or separation from affective attunement with the primary attachment figure (caregiver in childhood, close relationships in adulthood) either via lack, loss, abuse, neglect, or inability to attune. One of the ways in which the relationships between attachment, self-regulation, stress-response, and attunement have been investigated has been through heart rate and heart rate variability.

Attachment and ANS functioning. Heart rate variability (HRV) is a measure of ANS functioning that reflects the ability to adapt (consciously or unconsciously) to the environmental context and stimulus. HRV is a component of physiological regulation that is considered an index for emotion regulation ability (Beevers, Ellis, & Reid, 2010; McCraty & Childre, 2002). HRV is thought to reflect the degree of balance and fluidity or distressed functioning in the ANS. One of the reasons that researchers assert that HRV reflects emotion regulation capabilities is because many areas of the brain that are associated with ANS regulation also are associated with emotion regulation (Beevers et al., 2010). Relationships between HRV and attachment style have been investigated in attempts to understand attachment and ANS functioning (e.g., Diamond, 2005; Schneiderman, Zilberstein-Kra, Leckman, & Feldman, 2011). Conceptually and empirically, scholars have suggested that attachment security is a predictor of ANS functioning as seen in vagal tone (Diamond & Fagundes, 2010; Schore & Schore, 2008). This ANS functioning is thought to reflect communication within the body about physiological regulation of the stress (sympathetic) versus relaxation (parasympathetic) response. HRV patterns are thought to reflect ANS functioning, including sympathetic and parasympathetic tone (i.e., vagal tone; Porges, 2007). Thus, HRV is considered a measure of vagal tone.

Vagal tone is the influence of the parasympathetic nervous system on heart functioning (Schore, 2001). Sometimes called the "vagal brake," high vagal tone reflects the ability of a healthy parasympathetic nervous system to influence heart functioning while low vagal tone is seen when the sympathetic nervous system (stress response) is

dominant in the control of heart functioning (Porges, 2007). HRV is a non-invasive measure of fluctuations in heart rate. These fluctuations in heart rate are influenced by several factors, one of which is respiration. Heart rate naturally increases upon inhalation and decreases upon exhalation. Respiratory Sinus Arrhythmia (RSA) is a measure of these breathing related changes in HRV (Grossman & Taylor, 2007). High RSA is a signature of healthy, adaptive, neurological and pulmonary functioning and may be a critical component of successful self-regulation (Demaree et al., 2006; Porges, 2007). The measure of RSA rhythms reflects both ANS balance (including vagal tone) and cardiorespiratory functioning. Researchers have reported empirical evidence that RSA is negatively associated with attachment insecurity (e.g., Diamond, 2005) and attachment security is negatively associated with ANS reactivity (Schneiderman et al., 2011).

Summary

Investigating Attachment Theory is an important avenue for advancing knowledge of human development and effective prevention, treatment, and assessment of mental health issues. Attachment Theory is a holistic theory of lifespan development that integrates a host of theories and contemporary research, including psychoanalytic theory, social learning theory, systems theory, ethology, evolutionary biology, and psychobiology. As such, Attachment Theory is used to address the impact of inter and intrapersonal interaction on lifespan holistic development. Attachment relationships are thought to be imperative within human evolution, including survival, safety-regulation, and the formation of self-regulation. Attachment relationships are conceptualized as systems through which these evolutionarily essential tasks are organized and performed.

The human attachment system is highly complex and informs emotional, cognitive, social, spiritual, and physiological development. Attachment figure(s) play an important role in co-regulation across the lifespan, including the early formation and maintenance of self-regulation including emotional and physiological regulation. Conceptual and empirical support for the attachment behavior system, attachment communication, and attachment styles aid in the understanding of these processes. Attachment communication takes many forms and may be conscious or non-conscious, verbal or non-verbal. Attachment processes are intricately intertwined with psychobiological functioning, including the cardiovascular and neurological systems and, possibly, respiration. Attachment communication is influenced by both emotional and physiological regulation, including ANS functioning. Attachment processes involved with communication, self and co-regulation of emotion, and ANS functioning have been shown to be related to emotion regulation and may also be related to processes and patterns of breathing. In the following section, emotion-regulation, including relationships between attachment and emotion regulation, are discussed. The relationships between emotion-regulation and breathing are described in a latter section on breathing.

Emotion Regulation

Over the past two decades, research in the area of emotion regulation has grown exponentially (Gross, 1998; Koole, 2009). Researchers have developed empirical and conceptual support for emotion regulation as a critical framework for understanding and investigating the development and treatment of psychological problems and maladaptive

coping (Hopp, Troy, & Mauss, 2011; Sloan & Kring, 2010; Werner & Gross, 2010). In fact, researchers have reported that nearly all aspects of emotional experience and processing including attention to spontaneous emotion (Stifter, Dollar, & Cipriano, 2011), cognitive appraisal of emotion, and physiological experiences of emotion, can be regulated consciously and non-consciously (Hopp et al., 2011; Koole, 2009). This phenomenon of conscious and non-conscious responding to emotional experiences and processing is referred to as emotion regulation. The development of healthy emotion regulation strategies is considered a substantial accomplishment in human development (Stifter et al., 2011) and is associated with positive outcomes such as secure attachment (Waters et al., 2010), wellness (Karreman & Vingerhoets, 2012), physical health (Miller, Chen, & Cole, 2009), resilience and personal growth (Hopp et al., 2011). In fact, effective (adaptive) versus ineffective (maladaptive) emotion regulation strategies have great import across the lifespan and have been associated with differences in healthy versus unhealthy development among infants (Feldman, 2003), children (Stifter et al., 2011), adolescents (Shapero & Steinberg, 2013), and adults (e.g., Aldao, Nolen-Hoeksema, & Schweizer, 2010). Among young adults, effective emotion regulation is associated with holistic wellness including greater mental (Aldao et al., 2010), physical, and relational health (Diamond & Fagundes, 2010). The development and maintenance of emotion-regulation is a focus of attachment theory and, in addition to extensive conceptual support, researchers have reported empirical support for the assertion that emotion-regulation is essential to understanding the relationships between attachment and

mental health (Cloitre, Stovall-McClough, Zorbas, & Charuvastra, 2008). The growing body of emotion regulation literature has yielded both great insights and great debate.

Prominence of Emotion-Regulation in Mental Health Literature

The definition and functions of emotion regulation have been, and continue to be, the source of much disagreement, particularly in addressing the differentiation between emotion and emotion regulation, intrinsic versus extrinsic influences on emotion, and the role of emotion regulatory processes in achieving adaptive goals (Thompson & Goodman, 2010). Further, the terms emotion regulation, mood regulation, and affect regulation are sometimes used interchangeably (Koole, 2009) and sometimes differentiated (e.g., Rottenberg & Gross, 2007). Despite continuing debate, it is clear that these constructs are closely related. The empirical boundaries between them have been blurry and, accordingly, it is suggested that the construct of emotion regulation encompasses emotion, mood, coping, and affect (Koole, 2009). This broad conceptualization of emotion regulation has yielded a large body of multidisciplinary research and emotion regulation has been hailed as one of the most important and exponentially expanding areas of recent mental health research (Rottenberg & Gross, 2007). There are many levels at which emotion regulation has been studied including cognitive, neurobiological, relational, cultural, social, (Thompson & Goodman, 2010) and physiological factors (Liew et al., 2011). Illustrating the span, volume, and recent surge of multidisciplinary research, a worldcat.org search of the term “emotion regulation” revealed nearly 22,000 peer-reviewed articles and, remarkably, more than half (11,742) of these articles were published in the past 5 years (since 2008). These

numbers increased further when related terms (e.g., affect regulation or mood regulation) were included. There are a host of reasons for the recent surge in emotion regulation literature, including advancement in understanding of the relationships between emotion regulation and stress-response, the processes of emotional responding, the role of emotion regulation in positive holistic health outcomes, the development of emotion regulation as a conceptual framework for understanding mental health problems, and the role of emotion regulation in human attachment.

Emotion, Responding, and Regulation

Although emotion is thought to play a critical role in experiential, cognitive, behavioral, physiological, and relational processes, including adapting to environmental changes and organizing learning experiences (Schore, 2000), emotion has been and continues to be a difficult construct to define (Mauss & Robinson, 2009). One of the challenges in defining and measuring emotion is that not only is there a broad range of identified human emotions (e.g., fear, sadness, anger, joy, elation), but there also is great variance in the intensity, perceived desirability, and duration of emotion experienced over the course of daily life and lifespan developmental experiences (Rottenberg & Gross, 2007). Adding further complication, emotions are thought to manifest as primary, the initial emotional response, and secondary, the emotional response to the initial emotional response (Koole, 2009; Werner & Gross, 2010).

Characteristics of emotional responding have been identified to help researchers pinpoint some of the elusive nuances of emotion. Researchers have suggested that within the context of related experience, behavior, and physiology, emotion regulation includes

the regulation of attention, processes of classical conditioning, organizing affective information, and nervous system functioning (Thayer & Lane, 2000). Werner and Gross (2010) identified five typical features of emotional responses:

1. *Situational antecedents.* All emotion is thought to begin with a psychologically relevant trigger. The source of such triggers, or situational antecedents, can be internal or external, conscious or non-conscious.
2. *Attention.* Whether conscious or non-conscious, internal or external, an emotional response occurs only when the situational trigger is attended to.
3. *Appraisal.* When a trigger is attended to, the situation is appraised within the context of the individual's conscious and non-conscious goals. Both the formation of these goals and the appraisal of emotion in the context of these goals may be related to the individual's situational context, basic and survival needs, worldview, culture, social norms, personality, and stage of development. When a trigger is appraised as congruent with the individual's goals, emotions perceived as desirable or positive are thought to arise, whereas a trigger that is appraised as incongruent with the individual's goals likely results in emotions that are perceived as undesirable or negative.
4. *Response tendencies.* Each emotion has a unique profile of experience, physiology, and behavior (Mauss & Robinson, 2009); the coordination of these systems into sets of responses, or profiles, can be described as response tendencies.

5. *Malleability.* Emotions and emotional responding are subject to internal and external influence. Emotions can be interrupted and directed in ways that are either adaptive or maladaptive.

Adaptive and Maladaptive Emotion Regulation

The conceptualization of emotion regulation can be centered on these features of emotion responses and, specifically, the development of both adaptive and maladaptive patterns in attention, appraisal, and response tendencies. Some emotion regulation processes reflect conscious awareness and/or intentional efforts to control emotional experiences whereas other forms of emotion regulation are largely automatic and non-conscious (Koole, 2009). Emotion can be down-regulated, a response tendency aimed at reducing a particular emotion, or up-regulated, employing a response tendency that increases a particular emotion (Rottenberg & Gross, 2007), as well as monitored without instigating any specific change (Gratz & Roemer, 2004). Though emotions are thought to be crucial to adaptive development and functioning, regulation of emotion is not always adaptive or functional (Mennin & Fresco, 2010). Emotion regulation is considered maladaptive if the desired short-term effect (e.g., monitoring or down-regulating a painful emotion) is not accomplished or the long-term cost (e.g., down-regulating desirable emotion) is greater than the short-term benefit (Werner & Gross, 2010). Additionally, maladaptive emotion regulation strategies may manifest in diminished ability to experience and differentiate the full range of emotional experiences (Gratz & Roemer, 2004). For instance, an individual may develop a pattern of up-regulating a secondary emotion of anger in order to down-regulate a primary emotion of

sadness due to inability to adaptively experience sadness. Classifying adaptive versus maladaptive emotion regulation strategies depends upon the context of environment and goals as well as the individual's psychobiological history (Thompson & Goodman, 2010). Though the emphasis in the literature is often on emotion regulation as a process of modifying emotion, adaptive emotion regulation includes the ability to fluidly monitor, evaluate, and *at times* modify the intensity, duration, and/or discrete emotion that is experienced (Gratz & Roemer, 2004). The ability to effectively monitor, evaluate, and modify emotion requires complex development and maturation of experiential, behavioral, and physiological systems (Thompson & Goodman, 2010; Werner & Gross, 2010).

Emotion regulation and survival. In the context of evolution, the primary purpose of emotion is thought to be to motivate survival behavior (Mauss & Robinson, 2009). Emotions are thought to serve as an index of the individual's approach to adapting to the changing needs of their external (Thayer & Lane, 2000) and internal environment. In the modern environment, the approach to adaptation includes both basic motivations and higher order motivations, in both cases motivations may be internal or external (Mennin & Fresco, 2010). In this way, emotions are used to organize goal-directed behavior. In other words, generation of emotion is thought to precede and motivate immediate action (Mennin & Fresco, 2010). Accordingly, emotional responses include physiological, behavioral, and subjective (or experiential) responses. Physiological responses include ANS functioning and behavioral responses include communication (e.g., facial displays) and physical movement (e.g., fighting, hiding, or running).

Subjective/ experiential responses are thought to involve awareness of, attention to, and appraisal of feelings. For instance, when fear is experienced the activation of the stress-response (sympathetic activation) prepares the individual for action such as fighting, fleeing, or freezing. Attention is directed to the stimuli and emotion to inform the appraisal of the situation in the context of immediate danger, short, and long term goals. The behavior, or response tendency, is enacted in order to address the needs identified during appraisal, such as escape of possible harm. Although this description offers a fairly linear conceptualization of emotion response in the context of survival, systems of emotion and emotion responses are complex and non-linear.

Emotion regulation, CNS and ANS functioning. Like attachment and breathing, researchers have reported that emotion regulation is involved in both CNS and ANS functioning. In fact, measures of vagal tone (i.e., HRV and RSA) are generally accepted as physiological indices of emotional regulation (Porges, Doussard-Roosevelt, & Maiti, 1994). When internal and/or external environment is appraised as non-threatening, pleasant emotions such as joy may be cued, parasympathetic activation, also known as the relaxation response, occurs, and the needs of growth and restoration are prioritized (Porges et al., 1994). On the contrary, internal and/or external threats to perceived or actual safety cue emotions, such as anger, fear, or sadness, and sympathetic activation. When this happens, the stress (fight-flight-freeze) response occurs (Porges et al., 1994). For instance, beginning with Darwin's conceptualization of the rage-response, researchers have long conceptualized anger as the emotion motivating the fight response and fear as the primary motivation of the flight response (Kreibig, Wilhelm, Roth, &

Gross, 2007). In addition to support for links between the emotion of anger and the fight response, Darwin (1872, p. 74) provided an early glimpse at conceptual evidence for the interrelatedness of survival motivated behavior, emotion, and breathing in the following description of the rage response:

> Under this powerful emotion [rage] the action of the heart is much accelerated, or it may be much disturbed. The face reddens, or it becomes purple from the impeded return of the blood, or may turn deadly pale. The respiration is labored, the chest heaves, and the dilated nostrils quiver. The whole body often trembles. The voice is affected. The teeth are clenched or ground together, and the muscular system is commonly stimulated to violent, almost frantic action. . . . All these signs of rage are probably in large part, and some of them appear to be wholly, due to the direct action of the excited sensorium. But animals of all kinds, and their progenitors before them, when attacked or threatened by an enemy, have exerted their utmost powers in fighting and in defending themselves.

As previously discussed, while flexible ANS functioning (or vagal tone) is adaptive and evidenced by balanced functioning of parasympathetic and sympathetic activation, loss of ANS flexibility is considered maladaptive and is indicated by chronic sympathetic activation evidenced by low HRV and RSA (Porges et al., 1994). Measures of HRV and RSA are widely accepted as representations of vagal tone, flexibility of ANS functioning, and capacity to respond to stimulus in an adaptive way (Di Simplicio et al., 2012). Researchers have linked adaptive flexibility in ANS functioning with healthy patterns of breathing (Courtney et al., 2011a) and adaptive emotion regulation across the lifespan. Among young adults, ANS flexibility evidenced by higher HRV or RSA is associated with adaptive emotion regulation (Volokhov & Demaree, 2010). For instance, Volokhov and Demaree (2010) investigated the use of cognitive emotion regulation strategies (reappraisal and suppression) and RSA among young adults

(university students) exposed to positive and negative film clips (n = 113). Individuals with high baseline RSA (reflecting adaptive ANS functioning) reported significantly higher use of reappraisal (considered an adaptive emotion regulation strategy) and greater incidence of regulating emotion than individuals with low baseline RSA. Research in this area is frequently limited by small sample size, convenience sampling of university students, controlling for breathing in the analysis of HRV and RSA, and narrow or vague measures of emotion regulation (i.e., self-report of select cognitive strategies such as reappraisal and suppression, or discrete emotions such as fear or sadness). Further, additional research is needed on adult populations as much of the research on emotion regulation and ANS functioning has focused on children and adolescents (e.g., Diamond & Cribbet, 2012; Gentzler, Rottenberg, Kovacs, George, & Morey, 2012; Gentzler, Santucci, Kovacs, & Fox, 2009). Nonetheless, the links between ANS functioning and emotion regulation illustrate the intricate interaction between emotion regulation and physiological regulation within self-regulation; add support that there may be relationships among attachment, breathing, and emotion regulation; and also add further context for understanding the role of emotion regulation in the development of mental health problems as well as treatment and outcomes.

Emotion regulation and mental health. Maladaptive emotion regulation strategies are associated with poor mental health outcomes (Aherne, Moran, & Lonsdale, 2011) and reduced efficacy of short-term therapeutic interventions (Watson, McMullen, Prosser, & Bedard, 2011). Werner and Gross (2010) outlined a conceptual framework addressing the development of mental health problems in the context of emotion

regulation. They argued that regardless of a client's presenting concern (e.g., occupational or relational problems) or the organization of symptoms of psychological distress (e.g., anxiety, depression, addiction, or borderline personality), individuals experiencing mental health problems share a common and primary issue: intensity, duration, and types of emotion beyond what they are able to effectively regulate. This inability leads to experiential, cognitive, behavioral, and physiological experiences that have a negative impact on wellbeing and daily functioning and result in symptoms of mental health problems. The ability to effectively regulate emotions in triggering situations is considered essential to positive mental health outcomes (Stifter et al., 2011).

Emotion regulation strategies and processes. Researchers have developed many theoretical models of emotion regulation strategies, both adaptive and maladaptive, including models that address stress and coping as well as cognitive behavioral approaches. The predominant emphasis in the literature has been on cognitive strategies of emotion regulation such as the adaptive strategies of reappraisal and problem solving, as well as maladaptive strategies of suppression, avoidance, and rumination (Aldao et al., 2010; Kamholz, Hayes, Carver, Gulliver, & Perlman, 2006). Though these cognitive approaches to emotion modification have been dominant in emotion regulation research, cognitive approaches do not appear to comprehensively address the dimensions of emotional responding (experience, behavior, and physiology). More recently, researchers have identified additional strategies of mindfulness, awareness, and acceptance as adaptive emotion regulation strategies (Jimenez, Niles, & Park, 2010; Kamholz et al., 2006; Kemeny et al., 2012). Acceptance, avoidance, problem solving, reappraisal,

rumination, and suppression have been most commonly investigated in studies examining relationships between emotion regulation and mental health disorders.

For instance, Aldao et al. (2010) conducted a meta-analysis examining 241 effect sizes in 114 studies conducted between 1985-2008 that investigated the relationships among select emotion regulation strategies (i.e., acceptance, avoidance, problem solving, reappraisal, rumination, and suppression) and symptoms of psychopathology (anxiety, depression, disordered eating, and/or substance-related disorders). They used a random-effect model to assess each strategy across mental health problems as well as individually. Avoidance and suppression were found to be positively associated with mental health problems with medium to large effect sizes while problem solving and reappraisal were negatively associated with mental health problems with small to medium affect sizes. Maladaptive strategies of avoidance, suppression, and rumination were each positively associated with anxiety, depression, disordered eating and substance-related disorders and adaptive strategies of acceptance, reappraisal and problem solving were associated with fewer symptoms of these disorders. The largest effect sizes were seen between rumination and both anxiety and depression, while surprisingly the relationships between acceptance and mental health problems was not statistically significant. However, these results likely reflect that there were substantially more studies investigating maladaptive strategies in relationship to anxiety or depression than there were studies investigating adaptive strategies, substance use, or disordered eating. Though this analysis supports the assertion that maladaptive emotion regulation strategies are related to a variety of mental health problems, an analysis of more recent

literature would likely reveal new insights into both adaptive and maladaptive emotion regulation given the incredible volume of research that has been published since the cut-off of 2008 for inclusion in this study.

Additionally, researchers have suggested that processes underlying the use of emotion regulation strategies are just as critical as the strategies themselves and also allow for evaluation with fewer context specific confounds. Thus, citing the need for a comprehensive conceptualization and effective measurement instrument, Gratz and Roemer (2004) developed a conceptualization of emotion regulation in which they identified adaptive strategies of emotion regulation as not limited to cognitive emotion modification strategies, but also involving monitoring and modulation. Initially their conceptualization identified four areas of effective emotion regulation; however, a factor analysis was used in the development of an instrument designed to assess difficulty in these areas (the Difficulties in Emotion Regulation Scale) and identified six significant factors. The following are the six factors of emotion regulation identified:

1. Awareness of emotions,
2. Clear understanding of and ability to identify emotions,
3. Acceptance of emotions,
4. Ability to control impulsive behaviors while experiencing painful emotions,
5. Ability to behave in agreement with personal and situational goals while experiencing painful emotions,
6. Ability to use context-appropriate strategies to flexibly modulate emotion as needed in order to accomplish goals.

Difficulty in any of these areas of emotion regulation is thought to reflect varying degrees of maladaptive emotion regulation. These factors of emotion regulation also can be conceptualized to provide further conceptual support for relationships between attachment and emotion regulation.

Attachment and Emotion Regulation

As discussed in the earlier section on attachment, researchers investigating the role of attachment in the development and maintenance of emotion regulation have argued that the coordinated development of emotion regulation processes and strategies are shaped by attachment processes (Schore & Schore, 2008). In fact, several of the foundational assumptions of attachment theory directly relate to the development of emotion regulation. For instance, non-conscious internal experiences, including expectations, beliefs, and fantasies, are thought to shape emotion regulation, informing all features of emotional responding (Fonagy et al., 2008). Further, internal representations, or internal working models, of self-other relationships are thought to organize emotion regulation and related behavior (Fonagy et al., 2008). Additionally, the conceptualization of attachment integrates emotion regulation processes within the evolutionary systems promoting survival. The impact of attachment on emotion regulation begins in the earliest stages of development and has long-term impact. For instance, the attachment figure's responses to the environment and to the child—beginning in utero—informs the developing infant's or child's expectations of safety and threat in their environment (Thomson, 2007), which likely informs identification and appraisal of situational triggers as well as reaction tendencies. These early influences as

well as attachment relationships in later life have a remarkable impact on the organization of emotion regulation and, in turn, mental health outcomes.

Attachment and the organization of emotion responses. Attachment processes such as the attachment behavior system are thought to have developed over the course of evolution in order to organize survival behavior, including emotional responding and regulation (Mikulincer et al., 2003). For instance, attachment processes are thought to shape the development of self-soothing strategies (internalization of care-giver soothing strategies). When internal self-soothing strategies fail, the attachment behavior system is activated as the next regulation attempt (e.g., proximity seeking). The features of emotional responding can be understood in the context of the attachment behavior system and other attachment related processes.

The *situational antecedents* that result in painful emotions are those in which there is a high or increased-risk of perceived threat to safety, including but not limited to anticipation of separation or loss from an attachment figure. The identification of real or perceived threat as well as the processes of *attention* and *appraisal* are informed by attachment communication as well as the individual's internal representations or internal working models that shape short and long-term goals as well as the primary evolutionary goal of survival. The *malleability* of emotions allow for the opportunity for self-regulation, influence of co-regulation in attachment relationships, and the plasticity of regulatory aspects of psychobiological development across the lifespan. The *reaction tendency* in response to discrete emotions is based upon internalized self-soothing strategies and attachment style. For instance, when a trigger (situational antecedent)

inspires real or anticipated loss (assessed via attention and appraisal), the reaction tendency of an avoidantly attached individual might include the multifaceted coordination of stress-response (fight-flight-freeze; sympathetic activation), experiential numbing or dissociation of feeling (possibly managed via breath pattern), heightened physiological arousal (possibly maintained by breath pattern), and withdrawn behavior (an attempt to curb further exposure to perceived threat and deactivate attachment behavior system). In addition to the features of emotion responding, the factors of emotion regulation also can be conceptualized in the context of the attachment behavior system and attachment style.

Emotion regulation and attachment style. Attachment styles are associated with emotion regulation over the course of the lifespan. In adults, secure attachment has been associated with adaptive emotion regulation evidenced by use of adaptive strategies of reappraisal (Karreman & Vingerhoets, 2012), mindfulness (Pepping, Davis, & O'Donovan, 2013), acceptance, resilience (Karreman & Vingerhoets, 2012), problem solving, effective proximity seeking (Mikulincer et al., 2003), adaptive RSA and HRV baseline and reactivity (Volokhov & Demaree, 2010), and positive interpretations of relationship experiences and others facial expressions, behavior, and motives (Diamond & Hicks, 2004).

Security-based emotion regulation. Mikulincer et. al (2003) outlined an attachment style-based approach to conceptualizing emotion regulation. Within this framework, security-based emotion regulation is adaptive emotion regulation in which the securely attached individual is able to acknowledge emotion, display emotion, seek

protection and support when needed, engage in problem solving, and effectively down-regulate distress. These security-based strategies rely on a foundation of self-efficacy, understanding that difficult emotions are manageable, and belief that even highly distressing challenges can be overcome. These beliefs are thought to develop through secure attachment with an effective attachment figure. These characteristics and beliefs outlined by Mikulincer et al. (2003) parallel aspects of the factors of emotion regulation outlined by Gratz and Roemer (2004) of awareness, understanding, and acceptance of emotions combined with ability to control impulsivity, pursue goals despite difficult emotions, and use context-appropriate strategies (effective problem solving) to modulate emotion as needed. Likewise, difficulty in these factors may parallel insecurity-based strategies of emotion regulation. There are two types of insecurity-based emotion regulation strategies conceptualized by Mikulincer et al. (2003), hyperactive and deactivating strategies. Though individuals with insecure attachment likely draw on both hyperactive and deactivating strategies depending on their context, in general hyperactive strategies are associated with anxious attachment. Individuals who experience anxious attachment also tend to experience amplified appraisal of threats, heightened efforts to minimize distance, diminished self-view, and catastrophized beliefs. The hyperactive emotion regulation strategies associated with anxious attachment include catastrophizing, rumination, magnification, helplessness (McWilliams & Holmberg, 2010), and overactive proximity seeking (Mikulincer et al., 2003). Deactivating approaches are associated with avoidant attachment and include characteristics such as lack of awareness of negative emotions, literal and metaphorical distancing, denial of fear (Mikulincer et al., 2003), and

lack of empathy (Burnette, Davis, Green, Worthington, & Bradfield, 2009). Deactivating strategies associated with avoidant attachment include suppression, dissociation, and repression (Diamond et al., 2006).

Although the goal of security-based strategies are to alleviate distress and resume growth and exploration, the goal of insecurity-based strategies are to manage attachment system activation and minimize distress caused by threat and/or expected or actual inaccessibility or infectivity of the attachment figure (Mikulincer et al., 2003). Specifically, the goal of the deactivating response tendency is to deactivate the attachment system in order to avoid distress caused by anticipated unavailability of the attachment figure, whereas the goal of the hyperactive response tendency is to maintain activation of the attachment system via continuous perception of perceived threat. Though the conceptualization of these goals has not been investigated explicitly, Wei et al. (2005) conducted a study investigating emotion regulation, attachment, mood, and interpersonal problems among college students (n = 229) between the ages of 18 and 43. They reported that attachment anxiety and attachment avoidance were related to negative mood and interpersonal problems "through different and distinct" emotion regulation strategies (p.14). Attachment anxiety was associated with emotional reactivity. Emotional reactivity parallels the conceptualization of hyperactive strategies and can be described as heightened emotional reaction to stimuli, including the emotions of others, coupled with difficulty remaining calm, and feeling overwhelmed by separation from others (Skowron & Friedlander, 1998). Attachment avoidance was found to be related to emotional cut-off. Emotional cut-off is congruent with the conceptualization of

deactivating strategies and can be described as patterns of distancing from emotion, exaggerated independence, and denial of importance of others (Skowron & Friedlander, 1998). Reflecting the interpersonal impact of attachment and emotion regulation, anxious and avoidant attachment and the respective emotion regulation strategies of emotional reactivity and emotional cut-off accounted for 75% of the variability in interpersonal problems.

The conceptualization of security-based emotion regulation is also congruent with Cloitre et al.'s (2008) study investigating the relationships between attachment style, emotion regulation, post-traumatic stress disorder, and functional impairment among adult women (n = 109) with a history of childhood maltreatment within attachment relationships. They reported that emotion regulation mediated the differences in functional impairment between secure and insecure attachment. Insecure attachment was associated with diminished capacity to regulate painful emotions and reduced *expectation* of effective support from others. These findings support the conceptualized differences in goals motivating emotion regulation behaviors of secure versus insecurely attached individuals (i.e., to *minimize distress* caused by *expectations* of unavailable or ineffective attachment figure). Conceptualization and empirical investigation of emotion regulation in the context of attachment processes allows for dynamic understanding of the role of emotion regulation in lifespan human development and the development of mental health versus distress.

Summary

The development of adaptive emotion regulation is considered a critical achievement in healthy human development. Although adaptive emotion regulation is associated with healthy development across the lifespan, maladaptive emotion regulation is associated with the development and maintenance of a host of physical and mental health problems. Advancing understanding of emotion regulation and developing effective preventative and treatment interventions to promote adaptive emotion regulation is an important direction for mental health research. With some exceptions, researchers have primarily focused on explicit, or conscious, forms of cognitive emotion regulation. Investigating the processes of attachment and breathing in the context of emotion regulation may contribute valuable information about both conscious and non-conscious emotion regulation processes beyond cognitive approaches. Conceptual and empirical links among attachment, emotion regulation, and ANS functioning and RSA, provide support for relationships among conscious and non-conscious processes of attachment, breathing, and emotion regulation. Though the current literature provides links between breathing, emotion-regulation, and attachment, these relationships have not been investigated explicitly. In fact, characteristics of breathing often are controlled for in studies investigating attachment and emotion-regulation. The following section discusses breathing, including links between breathing, emotion regulation, and attachment.

Breathing

One of the most powerful tools humans have to shape experience and respond to the world is breathing (Demos, 2005; Elliott & Edmonson, 2006). From early Chinese

Medicine to the Hippocratic Corpus, links between holistic health and quality of breathing have been discussed across cultures for thousands of years (Elliott & Edmonson, 2008). Mental health interventions that center around breathing exercises including natural breathing (Lewis, 2006), coherent breathing (Elliott & Edmonson, 2006), pranayama (yogic breathwork; Brown & Gerbarg, 2009), therapeutic breathwork (Young, Cashwell, & Giordano, 2010), biofeedback (e.g., HRV feedback; McCraty & Childre, 2002), relaxation techniques (Goodwin, Lee, Puig, & Sherrard, 2005), and mindful exercise (Brown & Gerbarg, 2009; Lloyd, Tsang, & Deane, 2009; Mansky et al., 2006) are developing as evidence-based approaches to mental health treatment. The efficacy of breath related intervention in the treatment of mental health and promotion of holistic wellness may reflect, in part, the accessibility of breathing exercises and the relationships between breathing, emotion regulation, and ANS functioning. In light of the relationships between the ANS functioning and holistic health, the emerging body of evidence-based breath-centered approaches, and trends in consumer preferences, there is a growing need for the integration of breath-based approaches in counseling, counselor education, and related research (Elliott & Edmonson, 2006; Young et al., 2010). To date, the conceptual frameworks used to guide research on of the role of breathing in human health often have centered on ANS functioning (e.g., Courtney, Greenwood, Cohen, & van Dixhoorn, 2011b) and/or spirituality (e.g., Brown & Gerbarg, 2009). The conceptual framework of attachment theory may help to advance understanding of psychobiological attachment processes while refining understanding of the relationships among breathing, ANS functioning, lifespan human development, emotion-regulation, and generation

transmission of wellness versus distress. Advancing understanding of these relationships could aid researchers and mental health practitioners in the development and implementation of treatments that are affordable, sustainable, highly customizable, culturally appropriate, and yield outcomes that could have impact across generations. Accordingly, this section addresses the conceptual and empirical research on healthy versus dysfunctional breathing, breathing and physiological-regulation, breathing and emotion-regulation, and the hypothesized relationships between breathing and attachment.

Healthy and Dysfunctional Breath Patterns

Discerning between healthy and dysfunctional breathing (DB) patterns is essential to breath-related research and has proved valuable in advancing mental health treatment and research (e.g., Meuret, Wilhelm, & Roth, 2004). Challenges exist, however, related to defining and assessing DB (Courtney, Greenwood, & Cohen, 2011b). There has been no consensus definition of DB, though it is frequently described as disturbances in respiratory functioning that negatively impact health (Courtney et al., 2011b). There are many mechanisms involved in breathing and many commonly used single time point physiological measures do not appear to effectively capture prolonged breath patterns that result in symptoms of DB (Thomas, Mckinley, Freeman, & Foy, 2001). As such, diagnosis of DB remains challenging and has not been standardized (Courtney et al., 2011b; Thomas et al., 2001). As a result, DB has been under-investigated, with limited recognition of the impact of dysfunctional breathing patterns. Accordingly, DB often goes undiagnosed and untreated despite deleterious effects (Thomas et al., 2001).

Further, researchers have suggested that symptoms of DB often are misguidedly attributed to other phenomena "resulting in inappropriate investigations and ineffective treatment" (Thomas et al., 2001, p. 1098). For instance, though breath plays a pivotal role in both HRV and RSA, researchers sometimes overlook or erroneously control for breathing in related investigations. Still, some researchers have recognized the importance of investigating DB and risen to the challenge. These researchers have suggested that dysfunctional breathing patterns develop due to "mind-body mechanisms" (Han et al., 2004, p. 2), chronic stress, cardiovascular disease, and/or respiratory disease (Courtney et al., 2011a). To consider the literature in this area, it is first helpful to understand the mechanics of breathing.

Mechanics of breathing. Breath rate, volume, movement, depth, pause location, and duration are key characteristics of healthy versus dysfunctional breath patterns (Courtney et al., 2011b). When exposed to internal or external stressors, changes in breath pattern alter a host of respiratory and cardiovascular components including airflow, intrathoracic pressure, heart rate, blood flow, and blood pressure (Fokkema, 1999). Often, volume is used to refer to the lung capacity used during breathing, while in some cases the term volume may refer to specific actions in respiration such as the volume of air that is received upon inhalation or expelled on exhalation (Ward, Drysdale, Cunningham, & Petersen, 1979). Movement refers to the areas of the body that expand and contract during inhalation and exhalation. More specifically, the term movement often refers to breath-related movement that is externally visible. For instance, diaphragmatic activity is often seen in the abdomen, low to mid back, and solar plexus

while thoracic activity is seen in movement in the chest, mid to upper back and shoulders (Courtney, van Dixhoorn, & Cohen, 2008; Lewis, 2006). Depth typically refers to the role of the diaphragm in breathing and the differences between healthy versus unhealthy engagement of the diaphragm are reflected in the "depth" of the breath (CliftonSmith & Rowley, 2011). In some cases the term depth is used to refer to volume. This use of the term depth can be confusing as one may experience a fairly full volume without healthy engagement of the diaphragm such as full volume thoracic (chest) breathing seen in individuals who experience panic (Meuret, Ritz, Wilhelm, & Roth, 2005).

There are two major sets of muscles involved in breathing. The primary set are the muscles used under normal healthy conditions while the second set are associated with dysfunctional breathing (DB) and both physical and psychological distress (Davies & Moores, 2003; Timmons & Ley, 1994). The primary set consists of the diaphragm and the external intercostal muscles (the muscles in between the ribs). During physical exercise, the abdominal muscles also may be engaged in the primary set, but abdominal movement often is confused with desired diaphragmatic movement in "belly breathing." The difference between the two is an important discernment in identifying healthy versus dysfunctional breathing patterns. The movement of the diaphragm is responsible for up to 75% of breath volume in healthy breath movement and healthy diaphragmatic movement is associated with ability to achieve physiological coherence (Courtney et al., 2011a). When diaphragmatic movement is inhibited, however, other muscles (the second set) can take over much of the work (Davies & Moores, 2003). The second set of muscles (including the sternocleidomastoids, scapular elevators, and scalene) lift the

collarbones and shoulder blades (Timmons & Ley, 1994); thus, excess chest, clavicle and shoulder movement are often seen when diaphragmatic movement is restricted.

The diaphragm is an umbrella or half-dome shaped muscle that separates the chest and abdominal cavities of the torso (Long & Macivor, 2006). It is a smooth muscle that rhythmically moves under the direction of the ANS and can be controlled consciously or unconsciously. As we inhale, the diaphragm contracts, drawing downward, creating a partial vacuum and pulling air into the lungs (like drawing the plunger out to fill a syringe; Davies & Moores, 2003; Lewis, 2006). As we exhale, the diaphragm relaxes, releasing the vacuum and expelling air from the lungs. In addition to its function in breathing, the healthy movement of the diaphragm promotes overall physical health. For example, diaphragmatic movement gives a gentle massage (directly or indirectly) to vital organs including the heart, lungs, stomach, kidney, liver, pancreas and intestines (Lewis, 2006) while playing an important role in physical posture and stability (CliftonSmith & Rowley, 2011). Healthy diaphragmatic breathing reduces sympathetic activation and promotes the relaxation response (Peper & Tibbetts, 1997). Accordingly, healthy engagement of diaphragmatic breathing is associated with net ANS balance; increased blood circulation; increased lymphatic circulation; and increased blood flow to the brain, muscles, and vital organs (CliftonSmith & Rowley, 2011; Davies & Moores, 2003; Elliott & Edmonson, 2006).

Physiological coherence. Desired outcomes of breath-related interventions include the development of physiological coherence. Often, the term coherence is used in HRV-based biofeedback and refers to entrainment and stability among rhythmic

physiological activities including breathing, heart rate, and blood pressure, and is considered a marker of ANS balance and, thus, health promotion (Courtney et al., 2011a; Lehrer, Vaschillo, & Vaschillo, 2000). When individuals achieve heart rhythm coherence and continue to breathe with stable, synchronous frequency and depth, a phenomenon described as respiratory arterial pressure wave is seen in which the wave ascends with each exhalation and descends with each inhalation (Elliott & Edmonson, 2008). Elliott and Edmonson (2008) explained that the respiratory arterial pressure wave is maintained throughout coherence as follows. When the wave is present, the ANS moves in rhythmic vacillation toward sympathetic emphasis with each inhale and toward parasympathetic emphasis with each exhale. The outcome of this movement is considered net ANS balance and is evidenced by corresponding relaxation response in muscle tension, skin conductivity, blood flow, heart rate, arterial pressure, and brainwaves, and is typically accompanied by feelings of well-being. When the respiratory arterial pressure wave is chronically absent, ANS is imbalanced and the aforementioned systems, as well as holistic health, performance, and longevity, are negatively impacted. Inhalation is associated with sympathetic activation, including acceleration of the heart rate, and exhalation is associated with parasympathetic activation, including deceleration of the heart rate. In a state of coherence, these respiratory rhythms are synchronized with changes in heart rate whereas when the sympathetic activation is dominant, these physiological rhythms are asynchronous. Hence, respiration rate, depth, movement, volume, and overall pattern all play a fundamental role in ANS functioning.

Resting breath rate. Resting breath frequency (i.e., breath rate) is a commonly used gauge to identify possible breath dysfunction and assess and alter ANS functioning. There are several key terms related to respiratory phenomena associated with breath rate. Tachypnea refers to a respiration rate that is higher than normal (Mukerji, 1990). Hyperventilation refers to an increase in breath rate that is greater than necessary to meet metabolic needs (Humphriss, Baguley, Andersson, & Wagstaff, 2004). Increased breath rate can lead to hypocapnia, an imbalance in the arterial blood chemistry caused by reduction in the partial pressure of CO_2 (Humphriss et al., 2004). Hypocapnia is accompanied by symptoms that are caused by respiratory alkalosis and reduction in blood flow to the brain (Humphriss et al., 2004). End-tidal CO_2 partial pressure is a measure of expired CO_2 that often is used to assess this metabolic phenomenon. Symptoms associated with hypocapnia include, but are not limited to, tetany, dizziness, and cold hands or feet (Folgering, Haren, & Smits, 1990; Humphriss et al., 2004). Though researcher reports vary, in general 12-15 breaths per minute is a common resting breath rate among western individuals (Demos, 2005). A rate of 4-8 (Courtney et al., 2011a; Demos, 2005) breaths per minute combined with appropriate depth and volume promotes ANS balance. Some researchers cite 5-6 breaths per minute as the ideal rate for ANS promotion in most adults (Elliott & Edmonson, 2008; McCraty & Childre, 2010). Rates below 8 breath cycles per minute in conjunction with an otherwise healthy breath pattern are associated with increased parasympathetic emphasis and are typical among practiced meditators and regular biofeedback practitioners. A breathing rate of 8 -15 breaths per minute is thought to indicate mild sympathetic emphasis, 15-20 likely indicates moderate

sympathetic emphasis (indicative of tachypnea), and rates of 20 breaths or more may indicate severe sympathetic emphasis (Demos, 2005; Elliott & Edmonson, 2008). Chronic sympathetic emphasis is one of the deleterious symptoms of sustained dysfunctional breathing.

Dysfunctional breathing. Chronic dysregulation of breath rate, volume, movement, pauses, and/or depth are reflected in symptoms of dysfunctional breathing such as hyperventilation syndrome, perceived lack of air, and restricted movement. DB patterns originate with strained or constricted breathing in response to stress caused by internal or external triggers (Fokkema, 1999). When sustained DB has a psychological genesis, it is thought to develop as a maladaptive coping response to environmental stressors (Lalande et al., 2011). Researchers have reported that dysfunctional qualities of breathing may significantly contribute to both the development and maintenance of physiological and psychological health problems (Petersen, Orth, & Ritz, 2008; Ritz, Rosenfield, DeWilde, & Steptoe, 2010). This may be due, in part, to the impact that breathing has on the ANS (Elliott & Edmonson, 2008). The ANS entrains with breathing activity resulting in RSA. RSA can be described as respiration-related heart rate variability. RSA is associated with physiological self-regulation such as moderation of cardiac vagal tone (Grossman & Taylor, 2007) and body temperature (Lehrer et al., 2000). As such, RSA is frequently used as a measure of physiological regulation. Physiological and biochemical symptoms associated with dysfunctional breath patterns (including restricted diaphragmatic movement evidenced by reliance on other muscles for breath movement) include sympathetic nervous system dominance, blood vessel

constriction in the brain and extremities, decreased lymphatic circulation, decreased blood circulation, weakening of the pelvic floor and core strength, increased muscle tension, fatigue, and more (CliftonSmith & Rowley, 2011). Patterns of dysfunctional breathing have been associated with psychological distress, including symptoms of depression (Blazer & Hybels, 2010), anxiety (Wilhelm, Gevirtz, & Roth, 2001), panic (Garakani et al., 2009), trauma (Descilo et al., 2010), alexithymia (Plaza et al., 2006), and hallucinations (Allen & Agus, 1968; Timmons & Ley, 1994). For instance, in an unpublished exploratory study (Crockett, Cashwell, Bartley, Hall, & Young, n.d.), researchers investigated the relationships among breath pattern, heart rate variability, symptoms of dysfunctional breathing, alexithymia, depression, and anxiety in a sample of college students (n = 79). Significant positive relationships were found between symptoms of dysfunctional breathing and heart rate variability, anxiety, and depression. Symptoms of dysfunctional breathing also were found to account for 29.1% of the variability in anxiety, while limited diaphragmatic movement and inhale to exhale ratio accounted for 19.9% of the variance in alexithymia scores. The expected relationships between HRV, alexithymia, depression, and anxiety were not found, although this may have been due to limitations in HRV measurement and sample variance. Despite the preliminary support for links between patterns of breathing and mental health problems, the investigations into the relationships between DB and psychological symptoms have been minimal.

Symptoms and assessment of dysfunctional breathing. Though there are many nuanced characteristics of healthy versus dysfunctional breathing and much that is

unknown about breath patterns (Grossman & Wientjes, 2001), researchers have identified a range of symptoms that may emerge when a dysfunctional breath pattern is present. Depending on the breath pattern, DB may manifest in dimensions of symptomology related to hyperventilation, dyspnea ("the sensation of difficult or uncomfortable breathing"; Mukerji, 1990, p. 78), reduced or inflated breath volume, incomplete exhalation, breath holding, paradoxical breathing, diaphragmatic restriction, and/or restricted or exaggerated breath movement. Associated symptoms include irregularity, yawning, force (such as sucking in inhale or blowing out exhale), shortness of breath, and mouth-breathing (Courtney & Greenwood, 2009; Folgering et al., 1990; van Doorn et al., 1982). In the case of hyperventilation, symptoms also may reflect central and/or peripheral tetany that results from the metabolic effects of hyperventilation (van Dixhoorn & Duivenvoorden, 1985). Symptoms of tetany include but are not limited to tension, cold hands or feet, tingling, cramping, dizziness, and blurred vision (van Doorn et al., 1982). Dysfunctional breathing can be assessed in several ways, including self-report questionnaires, observation, manual assessment, and physiological measures (Courtney, et al., 2011a; Courtney & Greenwood, 2009; Perri & Halford, 2004). Self-report is frequently used in the assessment of DB symptoms, though validated questionnaires have not been extensively developed (Courtney & Greenwood, 2009). The Self-Evaluation of Breathing Questionnaire (SEBQ) was developed to fill this need and may be useful in the assessment, intervention, and research related to DB (Courtney & Greenwood, 2009). Though the SEBQ measures several dimensions of DB, it is not a validated measure of hyperventilation (Courtney & Greenwood, 2009) and validated

measures of hyperventilation typically measure only this dimension of DB (e.g., van Doorn et al., 1982). As such, to assess the known dimensions of dysfunctional breathing via self-report, multiple instruments may be necessary (Courtney & Cohen, 2008). One of the advantages of self-report measures is that researchers are able to investigate the result of unhealthy breathing patterns, symptoms of DB, without undertaking the difficulties associated with assessing breath pattern directly. Effective assessment of DB is critical to both research and clinical intervention. Accurate identification of DB symptoms and faulty breathing patterns may afford mental health practitioners the ability to customize treatment and utilize breath interventions that are appropriate for the characteristics of clients' particular breath pattern and related patterns of self-regulation.

Breath pattern and physiological regulation. Breath patterns impact and are impacted by the functioning of the ANS and, as such, conscious manipulation of breath pattern can be used to influence ANS functioning (Courtney et al., 2011a). The depth and pace of resting breathing may be key indicators of ANS balance and parasympathetic or sympathetic emphasis (Elliott & Edmonson, 2006; Vaschillo, Vaschillo, & Lehrer, 2006). Shallow depth combined with high frequency (fast breath rate) is associated with autonomic nervous system (ANS) imbalance including strong sympathetic activation, weak parasympathetic tone (i.e., vagal tone) and low heart rate variability amplitude. Shallow depth combined with low frequency (slow breath rate) is associated with ANS imbalance evidenced by weakness in both sympathetic and parasympathetic systems. Increased (diaphragmatic) depth combined with low frequency is associated with ANS balance, evidenced by weak sympathetic activation, strong parasympathetic tone, and

high heart rate variability amplitude; however, excessively deep breathing may stimulate sympathetic activation and inhibit the parasympathetic system. The depth and movement of the breath may be critical to effective physiological regulation. For example, Courtney et al. (2011a) investigated how dysfunctional breathing patterns related to participants' (n = 83) ability to optimize HRV and RSA. To assess breath pattern, researchers used Manual Assessment of Respiratory Motion (assesses motion of upper mid and lower rib cage and abdominals), the Hi Lo manual palpation technique (assesses paradoxical breathing, described as contraction of the abdomen and expansion the chest on inhalation despite instruction to breathe into the belly), and respiration rate. Subjects participated in a 5-minute biofeedback session with "coherence" instruction of paced breathing (slow, diaphragmatic breathing) combined with positive focus. Researchers found that breath pattern had a significant impact on ability to achieve heart rate coherence. For instance, participants with paradoxical breathing exhibited the lowest HRV coherence, and thoracic-dominant breathing also was significantly associated with decreased coherence. Researchers have suggested that these findings indicate that dysfunctional breathing is problematic due to both inefficiency and reduced physiological resilience (Courtney et al., 2011a).

Plasticity of breath patterns. Patterns of breathing have been shown to have context specific characteristics (Grossman & Wientjes, 2001) and sustainable profiles over time (Benchetrit et al., 1989). Further, breath patterns appear to be responsive to intervention (e.g., Schein et al., 2009a; Thomas et al., 2003; Wollburg, Roth, & Kim, 2011). Though some qualities of breathing pattern do vary throughout daily life

depending on various factors such as diet and activity, preliminary investigations (Benchetrit et al., 1989) have indicated that overall profiles of breathing may be identified and that emotion and cognition also are reflected in breathing pattern (e.g., McCraty & Childre, 2002; Philippot, Chapelle, & Blairy, 2002).

Profiles of breath patterns may be valuable in the investigation of physiological profiles that may be associated with patterns of attachment. Specifically, Benchetrit et al. (1989) conducted a longitudinal study to test previous literature suggesting that individuals have unique "personnalité ventilatoire" seen in trait-like patterns of breath volume, breath frequency, and "airflow shape" and to test the hypothesis that these patterns are stable over time (Benchetrit et al., 1989, p. 199). Data were collected from physically healthy participants (n = 16) at the first time point and then again between 4 and 5 years later (mean 51.5 months between data collection points). There are a host of factors that could have either short or long-term impact on breath pattern, including practice or training in activities such as breathwork, mindfulness (Brown & Gerbarg, 2009; Fahri, 1996), singing (Gick, 2011), or exercise (Boule, Gaultier, & Girard, 1989); biological factors such as age, weight (Benchetrit et al., 1989), pregnancy (Gilroy, Manguar, & Lavietes, 1988), respiratory or cardiovascular disease (Blechert, Wilhelm, Meuret, Wilhelm, & Roth, 2013); and lifestyle choices related to diet, smoking, caffeine intake, or other drug use (Benchetrit et al., 1989; Blechert, Wilhelm, Meuret, Wilhelm, & Roth, 2013). Though investigators did not account for all of the aforementioned variables, Benchetrit et al. (1989) reported that, despite changes in diet, exercise, health, and smoking, the breathing profile of most individuals remained consistent, with the

exception of one participant whose breathing profile changed significantly. It is important to note that generalizability of these findings are limited and to the best of the authors knowledge researchers have not attempted to replicate or further investigate these findings. Nonetheless, conceptually these findings reflect the possible stability of breathing patterns, potentially reflecting the stability of related emotional and physiological regulation strategies across time.

Though breath patterns may be consistent over time, humans also have the ability to consciously change their breath pattern. In conscious breathing, unconscious reflexes are temporarily over-ridden by conscious intentions to temporarily allow alteration of breath pattern (i.e., "breathwork") that changes physiological functioning including biochemistry, sympathetic and parasympathetic (vagal) tone, heart rate variability, and brain wave patterns (Altose & Cherniack, 2005; Brown & Gerbarg, 2009; Courtney et al., 2011a). Symptoms of DB are impacted by emotion, and psychological issues may be principal influences in some cases of dysfunctional breathing pattern (Courtney et al., 2011b). For instance, Han et al. (2004) conducted two studies to examine dyspnea, psychophysiology, and breath retraining. In the first study, patients with medically unexplained dyspnea (i.e., breathing problems with no known organic cause; $n = 111$), asthma ($n = 20$), respiratory disease ($n = 37$), and healthy subjects ($n = 192$) were investigated. Participants first completed self-report measures of hyperventilation symptoms, anxiety, and dyspnea. Participants then engaged in a breath-holding test, hyperventilation provocation test (HVPT), retest of the self-report dyspnea measure, retest of the breath holding test, and a final self-report symptom checklist for the HVPT.

Individuals with unexplained dyspnea reported the greatest symptoms of DB and highest levels of anxiety. The tests of breath-holding time and HVPT were congruent with self-reported symptoms of hyperventilation. The second study was a longitudinal investigation of the impact of breathing intervention on breathing among patients diagnosed with medically unexplained dyspnea (n = 64). The patients engaged in a minimum of 10 breath retraining sessions (average of about 24 sessions per patient). Pre-post measures administered consisted of a semi-structured interview, self-report measures of hyperventilation, dyspnea, and anxiety, HVPT and checklist, breath-holding time before and after HVPT, and patients' self-report of subjective improvement. For some participants (n = 28) end-tidal CO_2 partial pressure ($PetCO_2$) also was assessed after breath holding. The post measures were completed a minimum of 12 months post treatment. Participants reported improvement in subjective reports of daily quality of life, reduction in symptoms of dyspnea, hyperventilation, and anxiety. Researchers also reported improved breath-holding times and $PetCO_2$, and increased tolerance of the HVPT.

With practice and training, healthy breathing patterns can be practiced and relearned thereby helping to reinstate healthy respiratory, cardiovascular, and neurological functioning (Altose & Cherniack, 2005; Courtney et al., 2011a; Han et al., 2004). One of the limitations in this area of study is that when breath-related interventions (e.g., mindfulness, breathwork, relaxation techniques, etc.) are utilized in intervention studies, often the outcome measures are aimed at detecting changes in physiological problems (e.g., asthma, sympathetic emphasis) or mental health issues

(e.g., panic, anxiety, or depression) rather than explicit characteristics of breath patterns. As such, empirically supported understanding of the long-term impact of breath-related interventions on breath pattern is in its infancy.

Breathing and Emotion Regulation

In addition to the physiological impact of breathing, researchers have reported both anecdotal and empirical support for relationships between breathing, emotion, and emotion regulation (Brandt, Johnson, Schmidt, & Zvolensky, 2012; Elliott & Edmonson, 2008; Grossman & Wientjes, 2001; Philippot et al., 2002). Anecdotally, recognition of the connections between emotion and breathing are part of our everyday life as evidenced by commonly used expressions such as "breathtaking" or "sigh of relief" (Boiten, Frijda, & Wientjes, 1994). It is commonly recognized that an unexpected fear is often accompanied by a sharp in-breath or panting, that anticipation is often accompanied by "holding the breath," that disappointment is often accompanied by a sigh, and yawning is common during boredom (Boiten et al., 1994). Some people respond to emotional distress by telling themselves or others to "suck it up," referring to controlled breathing that enables one to endure emotional pain without explicitly expressing it outwardly. In fact, there is empirical support for relationships between characteristics of breathing, thoughts, and emotions, as both cognitions and emotions appear to have bi-directional relationships with breathing pattern (Fokkema, 1999). Still, this knowledge does not appear to be accompanied by common conscious awareness of breathing, healthy breath patterns, nor the importance of healthy breathing to holistic health. Although some researchers have studied the role of breathing in emotion regulation explicitly, the

relationships between these constructs often have been investigated implicitly or overlooked altogether. In fact, despite strong evidence supporting the role of breathing in physiological, emotional, cognitive, and behavioral health, breathing has been somewhat neglected in mental health research (Grossman & Wientjes, 2001). Investigators have suggested that the "sluggish" progression of research in this area may be due to challenges with measurement (Boiten, Frijda, & Wientjes, 1994; Courtney & Greenwood, 2009; Grossman & Wientjes, 2001, p. 44), the complexity of physiological systems involved and impacted by breathing (Boiten et al., 1994), the dismissal of its importance, and finally, that the physical and mental health issues related to dysfunctional breathing are not as immediately obvious as some other health issues (Grossman & Wientjes, 2001). Nonetheless, for more than 60 years researchers have offered valuable insight into the relationships between breathing and emotion regulation.

In a comprehensive literature review on the psychology of emotion regulation, Koole (2009, p. 28) identified breathing as a physiological process involved in emotion-regulation. Specifically, Koole identified processes of breathing as important to the reciprocal exchange of higher order psychological processes and bodily processes, in holistic, systematic, and emotion regulation. For instance, breath related factors are associated with discrete emotions (Philippot et al., 2002), overall mood (Butler et al., 2006; Ritz, 2004), and down-regulation of emotion (Scano, Gigliotti, Stendardi, & Gagliardi, 2013). Koole (2009) identified both bottom-up and top-down respiratory functions that may be critical to holistic, systematic, emotion regulation. Though many breath related processes in emotion regulation could be considered both bottom-up and

top-down strategies, bottom-up emotion regulation processes can be conceptualized as those in which bodily processes are used to influence the emotional and other psychological experiences via processes such as respiratory feedback (e.g., Zeier, 1984), paced breathing (Allen & Friedman, 2012), and other manipulation of breath pattern (Philippot et al., 2002). Top-down processes can be conceptualized as those that utilize higher order mental process to regulate bodily functions. In the case of breathing, top-down strategies could include mindfulness, self-awareness of breathing, or self-assessment of breathing pattern.

In other words, breathing pattern can be used to influence emotion and emotion also impacts patterns of respiration. For example, both acute experiences of emotion and daily mood have been associated with lung functioning (Ritz, 2004). Researchers conducted a study of lung functioning during two stress tasks and during films selected to induce states of anxiety, anger, depression, elation, happiness, contentment, or neutral (Ritz, Steptoe, DeWilde, & Costa, 2000). Researchers compared asthmatic adults (n = 24) and non-asthmatic adults (n = 24) on several physiological measures, including airway resistance. They reported that in both groups airways were constricted in response to emotional stimulation and during coping with stressful tasks. This emotion or stress-induced airway constriction also is consistent with literature on the role of breathing in vocalization (Huber & Spruill, 2008; Ritz et al., 2000). Other recent investigations into the relationships between breathing and emotion often have used breath-related measures of either RSA or breath pattern assessment.

Among adults, higher resting RSA (thought to reflect adaptive physiological and emotional regulation) is associated with healthy breath patterns (Courtney et al., 2011a) and has been shown to be associated with symptoms of effective emotional regulation including increased coping skills, impulse control, and effective self-calming strategies (Gyurak & Ayduk, 2008). RSA has been conceptualized as central to emotion regulation because RSA provides a negative feedback loop that allows for interruption of behavior and reorganization of resources (e.g., attention; Demaree et al., 2006). Some researchers have hypothesized that the potential protective factors of RSA for emotion regulation may be most evident in situations that evoke high emotions. For instance, Gyurak and Ayduk (2008) investigated the relationships between RSA, rejection sensitivity, and emotion control among undergraduate students (n = 40; mean age 21.41). RSA was positively associated with emotion control among those with high rejection sensitivity and conflict hostility, but this was not found across the whole sample. This is consistent with Diamond's (2005) finding that RSA mediated the relationship between anger and attachment but not distress and attachment among young adult males. Diamond suggested that this result may have reflected that the laboratory tests effectively evoked strong feelings of anger but did not successfully evoke strong feelings of distress.

In addition to relationships between RSA and emotion, researchers have conducted preliminary investigations and reported that there may be discrete breathing profiles associated with specific emotions. In one of the earliest modern studies investigating emotion, breath pattern and heart rate, Stevenson and Ripley (1952) reported that characteristics of breathing vary according to emotional experiences such as

pleasure, anxiety, anger, resentment, sadness, and guilt. Using observation and physiological measures, the researchers studied changes in breath rate, depth, ratio of inhale and exhale, and irregularity in a sample of adults (reported ages ranged from 20 to 42) with either a diagnosis of asthma (n = 15) or anxiety (n = 7) during an interview about the participants' emotional experiences. Emotional responses were evaluated using the content of participants' statements and observation of emotion such as tone of voice, facial expression, and body movement. Increased rate and depth were associated with anxiety while restricted rate and depth were associated with tension, feeling "on guard," and sadness. Breath irregularity was related to attempts to suppress anger, feelings of guilt, and episodes of crying. This study was limited by a small sample size, partial reporting of demographic information, and limitations of measurement including subjective observation. Additionally, the instrument used to assess changes in breath depth (a rubber tube around the chest attached to a pneumograph) indicated only thoracic movement and was not a standardized measure. Accordingly, changes in diaphragmatic movement were not measured and comparisons of changes in depth between participants were not plausible. Although limitations were numerous, this study highlights the long history of examining breath characteristics related to mental health issues.

Though empirical progress in this area has been slow, researchers have since supported the finding that there are distinct breathing patterns associated with specific emotions (Bloch, Lemeignan, & Aguilera, 1991; Philippot et al., 2002). Philippot et al. (2002) examined undergraduate students (n = 23) who volunteered to participate in a study about emotions and respiratory patterns. Participants were invited to use their

breath to induce a particular emotion; once participants reported feeling the targeted emotion they completed a self-report measure on the breathing pattern used during the feeling. Participants also rated the difficulty of producing the feeling. Researchers reported that the participants were able to produce feelings and patterns of breathing emerged. For instance, the feeling of joy was significantly associated with self-reports of fairly slow, full, regular breathing (a typical healthy resting breath pattern) whereas the feeling of fear was associated with faster, shallower, irregular breathing with some thoracic tension. In their second study, Philippot et al. (2002) invited undergraduate participants (n = 26) to engage in specific breath patterns and then report how they felt. Participants did not know the purpose of the study. Breathing was measured using a chest strap that measured frequency, amplitude, ratio of inhale and exhale, pauses, and holds. This approach may accurately measure thoracic related qualities of breathing but may not capture relevant mid and lower torso diaphragmatic movement. Still, there were four breath patterns were identified in the first study, associated with Joy, Anger, Fear, and Sadness. Participants were instructed in each breath pattern and then reported on the physiological and emotional experiences (items included feeling hot, racing heart, feeling sad, feeling aggressive, feeling happy, and positive feelings, etc.). Breathing patterns accounted for 40% of the variance in reported feeling. This is consistent with the results of Kreblbig et al.'s (2007) study of young adults (n = 34) in which they investigated patterns of physiological responses during films aimed at inducing feelings of either fear, sadness, or neutral. There were significant differences between fear, sadness, and neutral conditions on measures of heart rate, blood pressure, skin temperature, skin conductance,

respiration rate, end-tidal pCO_2, breath volume, and ratio of inhalation to total breath cycle. These findings also are consistent with Altose and Cherniack's (2005) review of literature on the behavioral control of breathing in which they reported that negative emotions significantly change resting breathing patterns whereas positive emotions cause minimal changes in resting breath pattern. These findings also are further support for reports that the coordination between the thoracic and diaphragmatic movement associated with breathing improves during relaxation and decreases during emotional distress (Takase & Haruki, 2001).

The relationships between patterns of breathing and emotional responses may offer valuable insight into self-regulation and attachment processes. At this point, the underlying reasons as to why breathing patterns change in certain psychological circumstances is largely hypothetical (Grossman & Wientjes, 2001). Chronic stress response is thought to lead to sustained negative emotional states (Schore & Schore, 2008). In addition to changes in breathing related to the stress-response, individuals may learn to consciously or unconsciously constrict breathing patterns as an attempt to restrict or avoid negative feelings (Elliott & Edmonson, 2008). Also, it is possible that patterns of healthy or dysfunctional breathing may be learned through entrainment or communication with others, such as attachment figure(s). Though regulating emotion in response via alterations in breathing such as frequency, altered volume, or diaphragmatic restriction may be adaptive short-term responses, the long-term result of these regulation attempts is maladaptive as evidenced by sustained habitual sympathetic activation (McCraty & Childre, 2002), difficulty regulating emotion, and symptoms of

dysfunctional breathing. It is possible that investigating breath patterns and emotion regulation in the context of attachment relationships may help researchers to understand both how dysfunctional breathing patterns are developed and how healthy breath patterns can be most efficiently established.

Breathing and Attachment

Researchers have suggested that individuals tend to match emotion and physiological functioning of attachment figure(s), and breath pattern impacts both emotion and physiological functioning; thus, it is possible that breath pattern also might be a process related to conscious and non-conscious attachment processes. Specifically, breathing may be critical not only to intrapersonal regulation of emotion and physiological functions but also to interpersonal attachment communication related to safety, survival, co-regulation and the development of self-regulation strategies. Potential connections between breathing and attachment are discussed in the context of breath pattern development, attachment communication, ANS functioning, and attachment styles. Gaps and limitations in this body of literature also are also discussed.

Attachment and breath pattern. Although there is much that remains unknown about how individual breath patterns develop, researchers have identified processes beginning in utero that may shape both acute breathing responses and long term breath patterns. Despite the conceptualization that infants "first breath" takes place at birth, fetal breathing is an essential part of development in utero and has been studied with measurable diaphragmatic movement and RSA (Gustafson, May, Yeh, Million, & Allen, 2012). Fetal RSA has been shown to be influenced by mothers stress levels and activities

such as exercise (Gustafson et al., 2012). Naturally, both stress and exercise impact the mother's patterns of breathing. Researchers have suggested that attachment processes also may begin to be shaped prenatally as prenatal maternal stress may bias the developing infants neurobiological development toward survival in a threatening rather than safe world (Thomson, 2007). The prenatal bodily-based communication of stress versus relaxation, and corresponding cues about the safety of the environment, may be a critical component of early attachment processes. Thus, it is possible that respiration may help to facilitate important conscious and non-conscious bodily-based psychobiological transactions between mother and infant beginning in utero.

Breathing and attachment communication. The conceptualization of bodily-based attachment communication reveals further support for links between breathing and attachment. For instance, Bowlby (1982) underscored the importance of "facial expression, posture, tone of voice, physiological changes, tempo of movement, and incipient action" (p. 120) in attachment related communication. It is noteworthy that qualities of breathing have been shown to impact many of these processes: facial expression (Demaree et al., 2006), posture and movement (CliftonSmith & Rowley, 2011), vocalization (Ley, 1999), and other physiological processes (e.g., HRV; Courtney et al., 2011a). It is possible that breathing plays an important role in non-verbal attachment communication as related to safety and emotion regulation. In addition to these aspects of attachment communication, breathing also may be an important process in key aspects and functions of attachment communication such as psychobiological attunement and self-soothing.

Breathing and facial expression. Beginning in early development and continuing over the lifespan, the ability to use facial expression to express and interpret emotion is critical in attachment-related communication (Steele et al., 2008). In addition to relationships between breath patterns and primary emotions (e.g., anger, sadness, fear), breathing also may be related to the production of facial expressions that communicate emotion (Philippot et al., 2002). Researchers have suggested that subtle changes in breathing not only occur during physical and cognitive tasks but also in interpersonal communication via modulation of facial expression (Grossman & Taylor, 2007). Further, researchers have suggested that ANS functioning and facial expression are regulated by the same psychobiological mechanisms, and vagal tone (as measured by HRV or RSA) may be directly related to the production of facial expression (Porges et al., 1994). Although investigations in this area have been sparse, breath pattern does appear to be related to facial expression in response to negative and positive emotional stimuli. For instance, Demaree et al. (2006) conducted a study of RSA baseline, RSA reactivity, facial response, and self-reported affect among young adults (n = 94) exposed to a negative and a positive film. They reported that while self-reports of affect did not predict facial response, baseline RSA did predict facial responses. Individuals with lower baseline RSA expressed greater facial expressions of negative emotion during negative film. Additionally, baseline RSA predicted RSA reactivity to the negative stimuli and indicated that individuals with greater vagal fluidity (associated with a more adaptive breath pattern) exhibit lower facial reactivity. These findings may indicate that healthy breath

pattern is associated with the ability to effectively regulate emotion and communicate emotional homeostasis and effective stress-reactivity facially.

Breathing and vocalization. In addition to facial expression, breathing is related to interpersonal communication by way of the modulation of vocalization (Grossman & Taylor, 2007). In fact, the vocalization of grunts, groans, cries, sighs, screams, gasps, laughter, and speech are all rooted in nuanced breathing maneuvers (Ley, 1999). The respiratory and laryngeal systems function in concert to provide pressure that manipulates vibrations of the vocal fold in order to produce vocalization (Huber & Spruill, 2008). ANS functioning regulate the muscle tone in the body, including the muscles involved in breathing and vocalization (Ritz, 2004). Muscle tension caused by sympathetic activation brings contraction into the airways while parasympathetic activation has a relaxing effect on the airways, including larynx and vocal cords (Ritz, 2004). Both processes impact vocalization. Changes in breathing are thought to impact both the development and maintenance of this vocal functioning, and changes in vocalization are often direct consequences of changes in respiration (Huber & Spruill, 2008). Further, the role of breathing in attachment communication about the safety of the environment may be particularly poignant in the case of vocalization due to changes in vocalization caused by the relationships between ANS functioning and the respiratory system, a key indicator of both perceived and actual safety.

Breathing, posture, and movement. Posture and movement also facilitate attachment communication (Bowlby, 1982), including emotion (Philippot et al., 2002). Posture, movement, and breathing pattern are thought to be interrelated such that changes

in one results in changes in the others (CliftonSmith & Rowley, 2011). In fact, the diaphragm plays a major role in both posture and skeletal stability and healthy posture is necessary for fully functional diaphragmatic movement. For instance, researchers have found that some symptoms of psychological distress such as panic and anxiety are associated with respiration irregularities that vary by posture (Kum ar Yergani, Radhakrishna, Tancer, Uhde, & Yeragani, 2002). CliftonSmith and Rowley (2011) described the positive feedback loop of one maladaptive breathing pattern (chest dominant, increased volume, mouth breathing) and poor posture summarized as follows. A spontaneous increase in breath volume (in response to some internal or external trigger) can result in increased muscle tension in the abdomen. In turn, this can have a "corset effect" (p. 76) that limits diaphragmatic movement and results in upper chest dominant breathing. This is seen in the over use of the secondary, less efficient, set of muscles involved in respiration. Due to the over use of these muscles, the upper spine and head is drawn forward and further muscle tension and joint compression occurs. The over exertion that is related to this inefficient muscle use results in mouth breathing. Since the movement of the diaphragm is constricted such that it cannot return to healthy functioning, both the poor posture and maladaptive breath pattern are maintained.

Breathing and attunement. Though the role of breathing in attachment related attunement has not been investigated explicitly, breathing may have an important role in the development and maintenance of individual-attachment figure synchrony. Attunement is critical to the formation of self-regulation, including self-soothing strategies. Facial expression, vocalization, posture, and movement, are all related to

respiratory functioning, and are each relevant in effective attachment-related attunement. Additionally, physiological functioning such as HRV and RSA are also important to both respiration and attunement. Self-soothing strategies are physically regulated by way of ANS functioning and accordingly greater ability to self-soothe is associated with higher HRV and RSA (Porges, 2007). For instance, respiratory and cardiovascular functioning and, accordingly, vagal tone and RSA, are essential not only to physical health but also are determinants of cognitive outcomes and emotion regulation and may impact the development of mother-infant attunement, also called synchrony (Feldman, 2006). Feldman (2006) conducted a study investigating the development of sleep-wake cyclicity, heart-rate variability, mother-infant synchrony, and emotion regulation. Infant-mother pairs (n = 71) were investigated in three groups, high-risk premature infants (low birth weight born before 30 weeks; n = 17), low-risk premature infants (between 34 and 35 weeks; n = 25), and full-term infants (born at 36 or more weeks; n = 29). For infants born prematurely, a weekly state observation and electrocardiogram (ECG) were collected. All infants' neonatal behavior was assessed at full-term (37 weeks for premature infants) and a state observation and ECG were conducted prior to discharge. At 3 months (adjusted to 40 weeks plus 3 months for premature infants), mother-infant reactivity and emotion regulation were assessed through videotaped interaction during a home-visit. Although differences in synchrony between groups were not significant, higher mother-infant synchrony was found among infants with higher vagal tone (higher RSA) across groups. The mother-infant attunement at 3 months appeared to depend upon the development of biological pacemakers (Feldman, 2006), including vagal tone as

measured by RSA. These findings are congruent with Feldman and Eidelman's (2007) study. The researchers reported that infant vagal tone (measured by RSA) and postpartum maternal behavior (gaze, vocalization, or touch) were each significant predictors of synchrony between both infant-mother and infant-father dyads. Though causal conclusions cannot yet be drawn, given the relationship between RSA and breath pattern, the association between RSA and infant-caregiver attunement may reflect greater attunement among dyads in which infants experience healthier breath patterns. As discussed in the previous section on attachment, self-regulation, and attunement, physiologically attuned attachment dyads appear to be more likely to exhibit secure attachment styles in both infancy (e.g., Zelenko et al., 2005) and adulthood (e.g., Sbarra & Hazan, 2008).

Though researchers of attachment and physiological attunement have not looked at breath pattern entrainment directly, outside of the attachment literature researchers have found that individuals may change breath patterns in response to the breath patterns of others. This entrainment may serve an important role in non-conscious bodily-based communication. For instance, Tibbetts and Peper (1993) examined the impact of researcher paced breathing on participant (n = 15) breathing pattern. In individual sessions, participants were taught how to use an inspirometer (a measure of breath volume often used in post-surgical breath rehabilitation) and instructed to breath normally; the volume of each participant inhale was monitored using the inspirometer. During phase 1, the researcher breathed normally and silently. During phase 2, the researcher engaged in paced breathing with softly audible exhales. The sound of the

researcher's exhale was intentionally paired with the participant's exhale. As the researcher engaged in paced breathing with complete exhales the volume of the participant's inhale increased. This volume increase is thought to occur in paced breathing because volume and breath rate often are negatively related. The generalizability of this study is limited due to small sample size and minimal reporting of sample demographics. The study also was limited in terms of the assessment of breath pattern, as volume is just one dimension of breath pattern. It is unknown how other characteristics of researcher breathing such as depth, rate, movement, and pauses may have impacted the breathing pattern of the participant. To date, there appear to be no studies in which researchers have attempted to replicate or further investigate these findings. Nonetheless, these findings indicate preliminary support for the assertion that non-conscious communication may include unconscious entrainment of breathing characteristics. Due to the relationships between breath pattern and other physiological systems such as cardiovascular and neurological systems, entrainment of breathing pattern could drive synchrony of other physiological processes, including heart rate, vagal tone, ANS functioning, RSA, and HRV. If so, in the context of relationships between these physiological processes and attachment, the impact of breathing on self-regulation may be partially understood in the context of non-conscious bodily based attachment communication that shapes the development and maintenance of self-regulation.

Possible relationships between breathing and attachment styles. Though breathing has not been explicitly studied in psychobiological research on attachment

styles, the literature reflects early relationships between attachment processes and physiological regulation (Fox & Hane, 2008), including breath related measures. For instance, in several strange situation studies, attachment security has been shown to predict heart rate variability. Strange situation studies also have supported the importance of physiological attunement in attachment processes. Zelenko et al. (2005) examined heart rates of 41 mother-infant dyads in the Strange Situation and found greater heart rate synchrony between mother and infant as well as faster return to heart rate baseline after reunification among securely attached dyads. Insecurely attached dyads exhibited lower heart rate synchrony with one another and, though they also experienced heart rate increases during separation, they did not return to baseline upon calming the infant at reunification. It is important to note that though differences between groups were seen, they were not statistically significant. Researchers reported this might have been due to Type II error as the power for the analysis was too low due to small sample size and disproportionate number of secure, insecure-anxious, and insecure-avoidant participants. Nonetheless, these findings may conceptually support that there may be a sustained stress-response after reunification as well as ineffective maternal regulation of infant arousal among insecurely attached mother-infant dyads. It also is possible that the lesser degree of physiological synchrony between insecure dyads also may reflect an ineffective internalization of regulation strategies among insecurely attached infants potentially due to ineffective external regulation of infant's needs. A similar study using more rigorous methodology, ample sample size, and additional physiological measures (i.e., measures of breathing) may offer valuable insight into these processes.

Several researchers also have investigated the relationships between attachment processes and ANS functioning among young adults (e.g., Diamond, 2005; Schneiderman, Zilberstein-Kra, Leckman, & Feldman, 2011). For instance, in a study of young adult men (n = 75), researchers investigated the relationships between attachment, RSA, and ANS reactivity. In addition to physiological measures, participants completed self-report measures of attachment and emotion, and endured baseline and recovery periods sitting quietly and periods in which they were engaged in tasks designed to evoke anger and anxiety. Secure attachment was positively associated with RSA and RSA mediated the relationship between perceived anger and emotional recovery in a controlled laboratory. The men who reported higher perceived security in attachment relationships showed faster RSA recovery from laboratory induced anger. RSA was negatively associated with overall attachment anxiety. Similarly, Schneiderman et al. (2011) investigated differences in vagal reactivity (measured by RSA) between 112 young adults who were either single (n = 57) or partnered in a 'loving' romantic relationship (n = 55). ANS reactivity (changes in RSA) to negative stimuli was lower among partnered adults possibly indicating more effective self-regulation among the adults with a romantic attachment figure. Researchers suggested that this relationship supports the concept that healthy adult attachment processes reduce stress and increase self-regulation capacity. The relationships between attachment and ANS functioning may be indicative of a significant relationship between breathing and attachment.

Limitations in the Literature

One of the largest limitations in the body of literature that could potentially offer links between breathing, emotion-regulation, and attachment is that, rather than being investigated itself, qualities of breathing (i.e., rate and depth) often have been controlled for in studies investigating attachment and self-regulation. For instance, Maunder et al. (2006) conducted a study to investigate relationships between attachment and stress. Measures of stress included physiological measures (HRV and RSA) and self-report measures. Attachment avoidance was found to be negatively associated with HRV. However, other expected findings (e.g., relationship between attachment anxiety and HRV) were not supported. This may be due to limitations with measurement and analysis of breath characteristics. The researchers used paced breathing (12 breaths per minute) during parts of the data collection protocol and also controlled for breath rate and depth in the data analysis. Though they discussed paced breathing as an attempt to isolate the portion of RSA that exclusively reflects vagal functioning, they offered no justification for the use of 12 breaths per minute and it is important to note that this pace is associated with activation of mild stress response (Elliott & Edmonson, 2008) which would be reflected in vagal functioning. In the case of HRV and RSA measure and analysis, there is debate about controlling for breath rate and depth. Supporters have argued that adjusting RSA measures by using paced breathing or controlling for breath depth and rate isolates the portion of RSA that reflects only vagal tone (e.g., Grossman & Taylor, 2007). Porges (2007) made a compelling argument that RSA should be used without adjustment for breath depth or rate and suggested that there is no benefit in doing

so. Breath pace directly impacts HRV, RSA, and vagal tone, so using paced breathing likely changes the very physiological function that is being measured (Allen, Chambers, & Towers, 2007). Nonetheless, relationships between attachment, emotion regulation, and physiological regulation (measured by HRV and RSA) often have involved the use of paced breathing during data collection (e.g., Maunder et al., 2006) and controlling for breathing in data analysis (Diamond, 2005; Maunder et al., 2006). Further investigations are needed to explore the relationships between attachment, emotion regulation, and breathing.

Summary

Breathing has long been hailed as critical to holistic health, yet popularity of breath-related interventions is a relatively recent development in the Western mental health fields. The recent popularity and effectiveness of breath-related mental health treatments may reflect, in part, the accessibility of breathing exercises and efficiency in the application of breathing to influence emotion regulation and ANS functioning. Discerning between healthy and dysfunctional breathing patterns is important to advancing mental health treatment and research. Breath pattern characteristics used to discern healthy versus dysfunctional breath patterns include breath rate, volume, movement, depth, pause location, and duration. Long-term dysregulation of breath pattern are reflected in symptoms of dysfunctional breathing, including hyperventilation syndrome, perceived lack of air, and restricted movement. Patterns of dysfunctional breathing have been associated with psychological distress, including symptoms of depression, anxiety, panic, trauma, and alexithymia. The relationships between DB and

psychological distress likely reflect the relationships between breathing, emotion, and emotion regulation. Intentional manipulation of breathing pattern can be used to influence emotion and emotion also impacts respiration. Adaptive RSA is associated with healthy vagal tone, adaptive emotion regulation, and healthy breath patterns. Emotion and mood impact respiratory functioning and there also is growing evidence that there may be distinct breathing patterns associated with discrete emotions. Individuals tend to match emotion and physiological functioning of attachment figure(s), and breath pattern impacts both emotion and physiological functioning. Further, breathing may play a pivotal role in bodily-based psychobiological attachment communication beginning in utero. Breathing may also be pivotal in attachment communication facilitated by facial expression, posture, movement, tone of voice, and attunement. Thus, it is critical to investigate the role of breathing in attachment and emotion regulation. Though attachment, breathing, and emotion regulation are relevant across lifespan development, investigating the relationships among these constructs among young adults is a relevant first step. The following section addresses developmental and mental health issues among young adults.

Young Adults

Though attachment, emotion regulation, and breathing are relevant across the lifespan, investigating the relationships among these constructs in a sample of young adults is an important step in exploring the relationships between these constructs. Mental health problems are growing among young adults and impact holistic health (Funk et al., 2010) as well as the health of their families (Stallard et al., 2004). The

escalating prevalence of psychological distress among young adults is a systemic issue and thus may create and reinforce generational patterns of insecure attachment, maladaptive self-regulation, and, accordingly, continued mental health problems within families (Stallard et al., 2004). These generational patterns are accompanied by long term mental health and physical health problems (WHO, 2013b) and patterns of abuse and neglect (WHO), 2012). Accordingly, the study of young adult attachment and self-regulation could provide much needed improvement in the efficacy and accessibility of the assessment and treatment of young adults. In turn, this could serve to improve young adult holistic health as well as prevention of distress, disability, disease, and social and economic hardship among subsequent generations. The following sections identify the population of interest and discuss the developmental and mental health issues of young adults in the context of the current study.

Developmental Stage of Young Adulthood

The first challenge in discussing the developmental and mental health needs of young adults is identifying exactly who is in this stage of development. The age range that is thought to encapsulate the developmental stage of young adulthood has been the subject of much debate. Even within researchers' descriptions of Erikson's (1959, 1963, 1968) stages of psychosocial development, young adulthood is said to occur between various ages such as 19-39 (Darling-Fisher & Leidy, 1988), 18-35 (Harder, 2011), 20-24 (Berecz, 2008), or 20-29 (Spano, Koenig, Hudson, & Leiste, 2010). Levinson (1978) argued that the transition to adulthood begins around the age of 17, with early adulthood spanning the ages 22-33. Differences in age range attributed to young adulthood have

become even more disparate over the years. For instance, researchers definitions of young adulthood include ages of 19-34 (Suvisaari et al., 2009), 18-30 (Rindfuss, 1991), 21-30 (Van Dorn et al., 2010), 24-34 (Silva, 2012), 18-24 (Park et al., 2006), and 19-22 (Campa, Hazan, & Wolfe, 2009). These disparities may reflect the assertion that development in young adulthood is quite complex (Hartmann & Swartz, 2006) and the ages at which individuals travel pathways (e.g., parenthood, education, career, military, travel, marriage, or cohabitation) to adulthood are increasingly varied (Park, Paul Mulye, Adams, Brindis, & Irwin, 2006). Due to these disparities, for the purpose of this study it may be most useful to define the age range of young adulthood based on the developmental markers and mental health issues of interest. Though there is debate about what constitutes the primary attachment relationship in adulthood, researchers widely agree that among adults romantic attachment may be the most likely primary attachment relationship and best estimate of primary attachment style. Though there has not been consensus on the age range that signifies young adulthood, it is widely agreed upon that love, intimacy, and partnership are important developmental tasks during this stage and the measure of romantic attachment is a focus of this study. Though marriage is by no means an all-inclusive marker, age of marriage may be a partial estimate of the developmental importance of romantic partnership in the United States (U.S.). In the U.S., the majority of individuals experience their first marriage between the ages of 20-35, approximately 23% of 20-24 year old women and 13% of 20-24 year old men are married (Uecker, 2012), and the majority of American citizens have been married at least once by age 35, including 83% of women and 75% of men (Goodwin, McGill, &

Chandra, 2009). Thus, it appears that developing adult romantic attachment relationships are extremely important to individuals in the age group of 20-35. Additionally, mental health problems among individuals in this age group are of serious concern. Accordingly, it may be important to include 20-35 year olds in the stage of young adults when investigating romantic attachment among young adults in the context of mental health research. For this reason, the focus of the current study is on participants between the ages of 20 and 35.

Challenges to healthy development in young adulthood. The healthy development of young adults is multifaceted. During this stage of development, many individuals strive toward the goals of establishing a committed romantic partner, a career, a household and, in many cases, becoming an effective parent (Hartmann & Swartz, 2006). Often, these goals are challenged by mental health problems (Suvisaari et al., 2009).

Young adults and mental health issues. The high rates of mental health disorders, suicide, and violent crime among young adults is quite concerning (Park et al., 2006). For example, the onset of depression and generalized anxiety most often occurs by the age of 30 (Kessler et al., 2012) and nearly 75% of lifetime mental health problems are thought to emerge by age 24 (Park et al., 2006; Suvisaari et al., 2009). In fact, in the U.S. suicide is the third leading cause of death among 20-24 year olds and the tenth leading cause of death across ages (NIMH, 2013). Similarly, rates of substance dependence and abuse are highest among young adults. For example, binge drinking and substantial alcohol consumption is estimated at 41.9% and 37.8% among ages 18-25 and 26-29

respectively (Park et al., 2006). Young adults are also at increased risk for victimhood of violent crimes and nearly one third of violent crimes are committed by young adults aged 18-29 (Park et al., 2006). Citing a need for integrative and empirically based approaches to meet the mental health needs of young adults, researchers have reported that positive outcomes for community based outpatient treatment of young adults, particularly short term approaches, are alarmingly low (Van Dorn et al., 2010). There is a great need for further research to develop comprehensive approaches to prevention, assessment, and treatment of mental health issues among young adults (Park et al., 2006; Van Dorn et al., 2010). These mental health issues are particularly concerning in light of the developmental tasks of this age group, which include partnership and parenting. Since both partnering and parenting are relational, it may be important, perhaps even essential, to consider mental health issues and developmental needs of young adults in the context of attachment and self-regulation. In fact, links between attachment style and various aspects of mental health (e.g., symptom reporting, help-seeking behaviors, health services utilization, and daily functioning) are thought to be attributed to self-regulation of emotional and physiological systems (Feeney, 2000; Sbarra & Hazan, 2008)

Romantic relationship and self-regulation. Young adulthood is a critical time for establishing adult attachment relationships and adult self-regulation. In addition to the pressure of social demands and developmental tasks, the mental health issues among young adults may reflect the maturation of maladaptive emotion regulation developed over the course of prenatal, infant, childhood, and adolescent development. In fact, researchers have suggested that because emotion regulation is developing and changing

throughout childhood and adolescence, the relationship between emotion regulation and mental health problems may be strongest among adults as patterns of self-regulation become more stable (Aldao et al., 2010). Researchers investigating self-regulation and co-regulation in adult romantic attachment have reported that securely attached dyads experience greater ability to maintain physiological and emotional homeostasis while their partner experiences distress. In turn, the distressed partner may be able to more quickly modulate distressing emotion and effectively regulate physiological systems. Unfortunately, however, the converse pattern is seen among insecurely attached dyads (Butner et al., 2007; Diamond, 2005). Though breathing may be an integral process in attachment and is a key element of both emotional (Koole, 2009) and physiological regulation (Courtney et al., 2011a), breathing has not been explicitly studied in this context. Given the mental health needs of young adults, the hypothesized relationships among attachment, breathing, and emotion regulation, and the relationships between secure adult romantic attachment, effective self-regulation, and mental health (Cloitre et al., 2008), advancing understanding of the relationships among these constructs in a sample of young adults is needed. Insights in this area stand to benefit young adults, their partners, and their off spring.

Generational impact. Though research on childhood psychosocial outcomes often has focused on the attachment relationship between mother and child (e.g., Feeney, 2000), there is growing evidence that quality and conflict within the attachment relationship between parents also has a significant impact on the development of self-regulation among their children (Volling, Blandon, & Kolak, 2006). Caregiver

relationship quality and conflict between caregivers is thought to impact the development of self-regulation (Towe-Goodman, Stifter, Mills-Koonce, & Granger, 2012; Volling et al., 2006) such as internalization of self-soothing techniques, modulation of emotion, and ANS regulation. Thus, the romantic attachment relationships formed in young adulthood may impact not only the self-and co-regulation of adult emotional and physiological systems but also the developing emotional and physical regulation of their children.

Summary

Mental health problems are rising among young adults and can impair all aspects of holistic health, including physical, social, familial, parental, occupational, and educational functioning. Integrative treatments are needed to address the unique developmental needs of young adults and intervention during this stage of development may also serve as preventative care for future generations. In adulthood, romantic relationships often supplant caregiver-child relationships as the primary attachment relationship. Young adult romantic attachment relationships may be critical in the self and co-regulation of emotional and physiological systems (including breathing) and the generational transmission of self-regulation and, accordingly, holistic health within family systems.

An Integrative Approach

Attachment theory, breathing, and emotion regulation are each indispensable in understanding the development, maintenance, and effective treatment of mental health problems. Further, there is conceptual and empirical evidence that these constructs are inextricably related. Integrating and testing the relationships among these constructs may

be useful to advance understanding of holistic health, including relational, emotional, cognitive, behavioral, and physiological aspects of adaptive versus maladaptive holistic health functioning across the lifespan and potentially across generations. In light of the substantial systemic nature and generational impact of the developmental tasks of young adulthood as well as the existing support for relationships among the constructs of interest in young adulthood, the initial exploration of relationships among attachment, breathing, and emotion regulation were explored in a population of young adults (defined as adults ages 20-35) in this study.

Summary of Relationships Among Constructs

There is conceptual and empirical support for links between attachment and emotion regulation, emotion regulation and breathing, and breathing and attachment. Emotion regulation can be conceptualized within the context of the attachment behavior system and attachment styles. For instance, attachment security-based emotion regulation is typified by ability to experience and modulate emotion as well as effective proximity seeking. Insecurity-based emotion regulation can manifest in the use of hyperactive and/or deactivating strategies, both of which involve difficulty experiencing and responding to emotion as well as patterns of ineffective proximity seeking. In fact, researchers have reported that strategies of emotion regulation are both different and discrete among secure, anxious, and avoidant attachment styles (Wei et al., 2005). Further, breath patterns and breath-related measures are associated with discrete emotions (Philippot et al., 2002), overall mood (Butler et al., 2006; Ritz, 2004), and down-regulation of emotion (Scano et al., 2013). Emotion regulation, attachment, and patterns

of breathing have all been shown to be important in ANS functioning as evidenced by vagal tone measured by HRV and RSA. Additionally, breathing has been associated with many processes of attachment, including bodily-based communication mechanisms of facial expression, posture, movement, vocalization, and psychobiological attunement.

Attachment, emotion regulation, and breathing are critical to human development across the lifespan. The development of attachment processes (Schore, 1997) and breathing patterns are believed to begin in utero (Gustafson, May, Yeh, Million, & Allen, 2012), during which time the fetus experiences predominantly external regulation of emotional and physiological systems as it is dependent on its mother and mother's environment (Calkins, 2004). Through infancy and early childhood self-regulation, the regulation of emotional and physiological systems, is primarily developed through co-regulation with the attachment figure. More specifically, this development of self-regulation is shaped by the interaction of relational, environmental, genetic, biological, and psychological processes including psychobiological attachment processes such as attunement (Schore & Schore, 2008), that may include patterns of breathing. Patterns of regulation and relating continue to evolve throughout adolescence, and though varying degrees of plasticity are maintained, stabilization of self-regulation patterns are thought to occur in young adulthood, at which point the primary attachment relationship is most commonly a romantic relationship. Co-regulation also occurs in adult attachment relationships and is thought to be primarily achieved through attachment communication related to both emotional and physiological regulation processes. Attachment communication involves processes of bodily-based communication and many processes

of bodily-based communication are associated with both emotion regulation and patterns of breathing, including facial expression, posture, movement, vocalizations, and the multifaceted process of psychobiological attunement.

Over-time, processes of co-regulation are internalized. These processes may include patterns of breathing, emotion regulation (including emotion modulation and self-soothing strategies), ANS modulation, and internal working models about self, others, and the environment that inform both physiological and emotion regulation. Thus, the development, maintenance, and plasticity of maladaptive or adaptive self-regulation is a sociophysiological phenomenon dependent upon both nature and nurture (Schore & Schore, 2008). It is hypothesized that individuals who experience insecure attachment develop patterns of distress evidenced by varying degrees of maladaptive emotion-regulation (Schore, 2009), symptoms of psychological distress (Cloitre et al., 2008), and maladaptive physiological regulation, including dysfunctional breath pattern (as evidenced by ANS functioning; Diamond, 2005). Due to an inability to effectively regulate emotion, and thus an inability to effectively respond to internal and external stressors, these individuals experience varying degrees of chronic sympathetic activation and physical and/or psychological distress occur. On the contrary, individuals who develop adaptive self-regulation likely experience features of holistic health, including secure attachment, adaptive emotion regulation, healthy patterns of breathing (associated with healthy physiological regulation as evidenced by ANS functioning), and the ability to effectively respond to distress. It is within this conceptual framework that the current study was conducted.

CHAPTER III

METHODOLOGY

In Chapter One, research questions were presented to explore the relationships among attachment, emotion-regulation, and breathing in a sample of young adults. In Chapter Two, a review of the relevant literature revealed support for the hypothesis that relationships exist among breathing, attachment, and emotion regulation. Further, it was revealed that breathing often is overlooked or used as a control variable in studies related to attachment and emotion regulation and that there is a need for research that more systematically integrates these factors. Accordingly, the current study contributed to the literature by testing relationships in an integrated model that combines these factors, potentially offering information into potentially effective avenues for prevention, assessment, and treatment. Specifically, relationships among reported symptoms of dysfunctional breathing, attachment styles, and emotion regulation strategies were explored among a sample of young adults. In this chapter, the research hypotheses of the study are detailed and participants, instrumentation, data collection procedures, and data analyses are described. The results and implications of the pilot study also are discussed in this chapter.

Research Hypotheses

The following research hypotheses correspond with the research questions presented in Chapter One:

Research Question 1: What are the relationships among romantic attachment (anxiety and avoidance dimensions), emotion regulation difficulties, dysfunctional breathing symptoms, hyperventilation, and diagnosis of breathing problems in a young adult sample?

Hypothesis 1.1: Greater symptoms of hyperventilation are related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion.

Hypothesis 1.2: Greater symptoms of dysfunctional breathing are related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion.

Hypothesis 1.3: Reported diagnosis of asthma and other breathing problems are related with greater symptoms of dysfunctional breathing and hyperventilation, difficulty regulating emotion, and higher romantic attachment anxiety and avoidance.

Hypothesis 1.4: Greater romantic attachment anxiety and attachment avoidance are related to greater difficulty regulating emotion.

Research Question 2: Are there differences in romantic attachment (anxiety and avoidance dimensions) and global difficulty in emotion regulation among individuals

who report symptoms of hyperventilation that indicate either clinically normal, mild, or significant symptoms of hyperventilation in a sample of young adults?

Hypothesis 2.1: Participants who report clinically significant hyperventilation symptoms report higher scores on romantic attachment (anxiety and avoidance dimensions) and greater difficulty regulating emotion than participants who report mild or clinically normal hyperventilation symptoms.

Hypothesis 2.2: Participants who report clinically normal hyperventilation symptoms report lower scores on romantic attachment (anxiety and avoidance dimensions) and difficulty regulating emotion than participants who report mild or clinically significant hyperventilation symptoms.

Research Question 3: What percentage of the variance in romantic attachment (anxiety and avoidance dimensions) is accounted for by breathing symptoms (symptoms of hyperventilation and dysfunctional breathing) in a sample of young adults?

Hypothesis 3.1: Symptoms of hyperventilation and dysfunctional breathing account for a significant portion of the variance in romantic attachment anxiety among a young adult sample.

Hypothesis 3.2: Symptoms of hyperventilation and dysfunctional breathing account for a significant portion of the variance in romantic attachment avoidance among a young adult sample.

Research Question 4: What percentage of the variance in emotion regulation difficulty is accounted for by breathing symptoms (hyperventilation and dysfunctional breathing) and romantic attachment dimensions in a young adult sample?

Hypothesis 4: Symptoms of hyperventilation, dysfunctional breathing, and romantic attachment dimensions account for a significant portion of the variance in global emotion regulation difficulty.

Research Question 5: Are the relationships among breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty in a young adult sample moderated by romantic attachment (dimensions of avoidance and anxiety)?

Hypothesis 5.1: Romantic attachment anxiety moderates the relationships between breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty among a young adult sample.

Hypothesis 5.2: Romantic attachment avoidance moderates the relationships between breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty among a young adult sample.

Participants

The population of interest for this study is young adults who have experienced one or more adult romantic relationships. Online sampling and survey administration was used to capture the population of interest and minimize socially desirable responding. An online sampling service, ResearchMatch.org, was used to obtain a geographically diverse sample of young adults between the ages of 20-35 who have been in at least one adult romantic relationship. Additional inclusion criteria are that participants must be able to read at an 8th grade level and have internet access.

To determine the sample size necessary for the current study, an a priori G*Power analysis (Faul, Erdfelder, Buchner, & Lang, 2009) was conducted for each research

question. Research question 1 required the largest sample size of 191, using an alpha level of .05, modest effect size of .20 (small effect .10, medium effect .30; Cohen, 1988), and a desired power of .80 for a two-tailed correlation analysis. 733 individuals were contacted through ResearchMatch.org with an email containing a link to the online informed consent and survey, 203 participants accepted the informed consent and completed the survey.

Instrumentation

The instrumentation for the current study consisted of five measures: (a) demographic questionnaire, (b) Experiences in Close Relationship Revised (ECR-R; Fraley, Waller, & Brennan, 2000), (c) Nijmegen Questionnaire (NQ; van Doorn, Folgering, & Colla, 1982), (d) Self-evaluation of Breathing Questionnaire Version 2 (SEBQ-2; Courtney & Greenwood, 2009), and (e) Difficulties in Emotion Regulation Scale (DERs; Gratz & Roemer, 2004).

Demographic Questionnaire

The demographics questionnaire consisted of 19 items that captured demographic characteristics (e.g., age, education, race/ethnicity, relationship timing and status, sexual orientation), factors identified in the literature to impact breathing characteristics (e.g., age, pregnancy status, breathing problems, heart problems, weight, current mind-body practice, voice training, smoking, and caffeine intake; Benchetrit et al., 1989; Courtney et al., 2011a; Philippot, Chapelle, & Blairy, 2002). These demographic items were used to describe the sample.

Experiences in Close Relationship – Revised (ECR-R; Fraley, Waller, & Brennan, 2000)

The ECR-R is a 36-item self-report measure of adult attachment (Ravitz et al., 2010). A Microsoft Flesch-Kincaide word readability analysis indicates the ECR-R has a reading level of approximately 8th grade. The basis of the ECR-R is that there are four attachment styles/categories (secure, preoccupied/anxious, dismissing avoidance/avoidance, and fearful avoidance/disorganized) associated with two dimensions of anxiety and avoidance (Brennan et al., 1998). Participant scores on the two dimensions can be used as continuous or categorical data. For instance, a participant who has a low score on both anxiety and avoidance dimensions could be categorized as securely attached. The dimensional approach to measuring attachment allows for understanding the level of attachment and prevents loss of information that can occur in exclusively categorical approaches (Fairchild & Finney, 2006). The continuous scores on both the anxiety and avoidance scales were used as units of analysis for questions 1-5.

In developing the original ECR, Brennan et al. (1998) developed a pool of 323 items based upon the existing literature in this area. The final items selected for the ECR were the 18 items with the highest absolute structure weights for each of the two scales (Fairchild & Finney, 2006). Fraley et al. (2000) used item response theory and the original pool of 323 items to revise the ECR. The purpose of this revision was to improve item-response metrics of the scales, specifically the precision of secure attachment measurement. The resulting ECR-R consists of 36 items, 18-items per scale (Fraley et al., 2000) that takes approximately 5-15 minutes to complete (Ravitz et al.,

2010). In most samples there is minimal to moderate correlation between the anxiety and avoidance dimensions (Ravitz et al., 2010). The ECR-R Anxiety subscale retained 13 of the original ECR Anxiety items, and included items such as "I worry a lot about my relationships" and "I'm afraid that I will lose my partner's love." The avoidance subscale retained 7 of the original items and includes items such as "I prefer not to show a partner how I feel deep down" and "I am nervous when partners get too close to me" (Fairchild & Finney, 2006; Fraley et al., 2000). The ECR-R items are quantified on a 7-point Likert scale with responses ranging from (1) strongly disagree to (7) strongly agree.

Though measuring secure attachment as precisely as insecure attachment remains a challenge, researchers have documented acceptable levels of reliability and validity for the ECR-R. The evidence for internal consistency for the ECR-R is good, with $\alpha = 0.92$ for the Anxiety subscale and 0.93 for the Avoidance subscale (Fairchild & Finney, 2006). Fairchild and Finney (2006) provided support for the two-factor model. The standardized root mean square residual (SRMR) was used to assess model fit and fell below .08 (SRMR = .072), and the comparative fit index was greater than .95 (CFI = .96; Fairchild & Finney, 2006). Latent factors were moderately correlated (r = .51; Fairchild & Finney, 2006). Convergent and discriminant validity was established in a study comparing responses on the ECR-R with the Relationship Questionnaire (RQ) and the Social Interaction Diary; results indicated construct validity of the ECR-R as a measure of adult romantic attachment (Sibley, Fischer, & Liu, 2005). Fraley et al. (2000) found that, though improved from the ECR, the ECR-R measures secure attachment with considerably less accuracy than insecure attachment. The sample used to develop the

ECR-R was comprised of 1,085 undergraduate psychology students (682 women, 403 men) from the University of Texas at Austin. The median age at the time of the testing was 18 years (range = 16-50) (Fraley et al., 2000). Among participants, 487 reported serious romantic involvement, 220 reported casual dating, and 376 reported no romantic involvement (Brennan et al., 1998). Further demographic information was not reported.

Nijmegen Questionnaire (van Doorn et al., 1982)

The NQ is a 15-item self-report measure of hyperventilation symptoms that was developed as a clinical measure of one type of dysfunctional breathing often described as hyperventilation syndrome (HVS; van Dixhoorn & Duivenvoorden, 1985). The results of a Microsoft Flesch-Kincaid word readability analysis indicate that the NQ requires approximately a 6th grade reading level to complete. Each of the 15 items is a symptom of hyperventilation. A team of specialists unanimously chose these items from a pool of 45 symptoms of the clinical diagnosis of HVS (van Doorn et al., 1982). A 16th item "anxiety" was included in the original NQ but researchers suggested dropping this item as it is not thought to be a discrete symptom of HVS (van Dixhoorn & Duivenvoorden, 1985). Though the NQ measures only one dimension of dysfunctional breathing, it is the most commonly used measure of dysfunctional breathing in clinical settings and empirical research (Courtney, 2011; Rowley & Phys, 2004). Though the 16-item version is commonly used (e.g., Thomas, Mckinley, Freeman, & Foy, 2001), it is the 15-item version that was examined to determine factor structure and predictive validity of the HVS (van Dixhoorn & Duivenvoorden, 1985). The items are quantified on a 5-point Likert-type scale with responses ranging from (0) never to (4) very frequently. Possible

scores range from 0 to 60. Though reports of clinical cut-off scores vary (e.g., Courtney et al., 2011a; Doorn et al., 1982; van Dixhoorn & Duivenvoorden, 1985), it is generally agreed that total scores of 10 or below are clinically normal while scores of 11-21 may indicate mild hyperventilation and scores of 22 or higher indicate evidence of clinically significant hyperventilation syndrome (Courtney et al., 2011b). The total score was used as the unit of analysis in the analysis of each of the research questions and the cut-off scores were used to categorize participants in the analysis of question 2.

Researchers have reported evidence for acceptable test-retest reliability of the NQ ($\alpha = .87$; Courtney, van Dixhoorn, Greenwood, & Anthonissen, 2011c). To test the factor structure and validity of the NQ, researchers (van Dixhoorn & Duivenvoorden, 1985) conducted a study evaluating the NQ scores of a group of adult patients with a diagnosis of HVS ($n = 75$) and a group of healthy adults who completed a breath therapy training and had no history of hyperventilation syndrome (non-HVS; $n = 80$). Van Dixhoorn and Duivenvoorden (1985) conducted a non-metric principal components analysis to evaluate the dimensional structure of the NQ. This study supported a 3-dimensional structure for the 15-item NQ: shortness of breath, peripheral tetany, and central tetany. The shortness of breath dimension has 7 items thought to reflect an inability to breathe freely. These symptoms include "palpitations" and "feeling tense." The other two dimensions address symptoms of tetany; these items reflect the impact of hyperventilation on metabolism including symptoms of changes in blood chemistry and ANS functioning. The peripheral tetany dimension has 4-items such as the symptoms of "cold hands or feet" and "tingling fingers." The central tetany dimension includes 4-items that address symptoms including

"dizzy spells" and "blurred vision." Van Dixhoorn and Duivenvoorden (1985) also found evidence that the NQ can be used to effectively differentiate HVS patients from non-HVS patients. Using discriminant analysis, researchers found that the NQ total score accurately classified participants as either HVS or non-HVS at a rate of 93% with a true positive prediction rate of 94% and a true negative prediction rate of 92%. In addition to predictive validity, the NQ has been shown to have acceptable convergent validity. For instance, researchers have reported that, in a comparison of pre-post breath retraining measures, changes in NQ score had a strong positive correlation with changes in the Asthma Quality of Life Questionnaire in a sample of 227 adult asthma patients (r = .59; Thomas et al., 2003). Convergent validity also has been shown through comparison with the SEBQ as described in the following section.

Self-Evaluation of Breathing Questionnaire-Version 2 (SEBQ-2; Courtney & Greenwood, 2009)

The SEBQ-2 is a 25-item self-report measure of dysfunctional breathing. According to a Microsoft Flesch-Kincaid word readability analysis, the SEBQ-2 requires a 3rd grade reading level. The SEBQ-2 was developed to address the need for validated instruments of dysfunctional breathing that measure symptoms of dysfunction beyond hyperventilation. Over the course of the development of the SEBQ, there have been several iterations including 17-item, 12-item, 25-item (Courtney & Greenwood, 2009), and 18-item versions (Courtney et al., 2011b). The 25-item version is suggested by the authors as a broadly representative measure of dysfunctional breathing (Courtney & Greenwood, 2009) and is the version that was used in this study. All items are endorsed

on a 4-point Likert-type scale from (0) never/not true at all to (3) very frequently/very true. The minimum score is 0 and the maximum score is 75. There is currently not a cut-off score for clinical significance, though higher scores indicate higher levels of perceived breathing dysfunction. The total score was used as a unit of analysis in research questions 1, 3, 4, and 5.

To date, there have been investigations into the reliability and validity of the SEBQ-2 (Mitchell, 2011), but a factor analysis has not been completed on the full 25-item version. Researchers developed items to assess several areas of dysfunctional breathing, including perceived lack of air, restricted breath pattern, and other breathing descriptors. Included in the 25-item version are symptoms such as "I find myself breathing through my mouth during the day", "I notice myself yawning", "I notice myself breathing irregularly", "I notice myself breathing shallowly", "I find myself holding my breath", and "I get breathless even when I am resting." Mitchell (2011) reported that endorsement of items such as "my rib cage feels tight and can't expand", "my breathing is heavy," and "I get breathless even when I am resting" were associated with the highest total scores.

Researchers reported evidence for good test-rest reliability with acceptable Intraclass Correlation Coefficients of .84 to .91 (Mitchell, 2011). Though correlation with the NQ offers support for convergent validity, researchers have maintained that the SEBQ measures characteristics of dysfunctional breathing that are not measured by the NQ and also that the SEBQ cannot be used as a clinical measure of hyperventilation. Unfortunately, however, these researchers did not investigate the 25-item version but

rather reported correlations between the SEBQ and NQ for the 17-item (r = .59; Courtney & Greenwood, 2009), 18-item (r = .75), and 12-item (r = .275; Courtney & Greenwood, 2009) versions. To some extent, though, validity of the 25-item SEBQ-2 was supported by expected relationships to chronic respiratory disease, respiratory illness, and smoking (Mitchell, 2011). Specifically, in a convenience sample of adults who were not incapacitated by illness, Mitchell (2011) found that participants who reported a diagnosis of respiratory problems scored an average of 69% higher on the SEBQ than those who did not report respiratory disease. Participants who reported a recent experience of acute respiratory infection scored an average of 29% higher than those who did not report recent respiratory illness. Participants who classified themselves as smokers scored an average of 51% higher than non-smokers.

Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004)

The DERS is a 36-item self-report measure of emotion regulation that was developed as a comprehensive measure of emotion regulation. The DERS has a 7th grade reading level (Vasilev, Crowell, Beauchaine, Mead, & Gatzke-Kopp, 2009). The DERS items are quantified on a 5-point Likert-type scale with responses ranging from (1) almost never to (5) almost always. The minimum total score is 36 and the maximum score is 180. Scores on the DERS can be used as individual subscales as well as a total score scale, higher scores indicate greater difficulty in emotion regulation. For the current study, the total score was used as the unit of analysis to indicate difficulties in emotion regulation for research questions 1, 2, 4 and 5. The scores for individual subscales were also used as units of analysis for research question 1.

Initially, the DERS was comprised of 41 items that were developed based on the literature and professional expertise. The items were developed in an attempt to capture respondent's reports of the "flexible use of situationally appropriate strategies to modulate emotional responses" (Gratz & Roemer, 2004, p. 43). The structure of the DERS items was based upon The Generalized Expectancy for Negative Mood Regulation Scale (NMR; Catanzaro & Mearns, 1990), a commonly used measure of emotion regulation. Specifically, 27 of the 36 final items begin with the phrase "when I'm upset" to capture the respondent's strategies for modulating emotional responses during times of distress. Based upon preliminary and exploratory factor analysis, 5 items were dropped due to either low correlation with the overall scale score or a factor loading of lower than .40 (Gratz & Roemer, 2004). The exploratory factor analysis supported six dimensions measured by the DERS: nonacceptance of emotional responses, difficulties engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. The correlations between the six dimensions range from extremely low (r = .08; lack of goal-directed behavior and lack of emotional awareness) to moderate (r = .63; nonacceptance of emotional responses and limited access to emotion regulation strategies).

The nonacceptance of emotional responses subscale (nonacceptance) has 6 items and evidence has been found for acceptable internal consistency (α = .85; Gratz & Roemer, 2004). The nonacceptance subscale includes items such as "when I'm upset, I feel guilty for feeling that way" and "when I'm upset, I feel like I am weak." The difficulties engaging in goal-directed behavior (goals) subscale has evidence of

acceptable internal consistency (α = .89; Gratz & Roemer). This subscale is comprised of 5 items such as "when I'm upset, I have difficulty getting work done" and "when I'm upset, I have difficulty focusing on other things." The impulse control difficulties subscale (impulse) consists of 6 items with evidence for internal consistency (α = .86; Gratz & Roemer). Items in the impulse subscale include "when I'm upset, I lose control over my behaviors" and "I experience my emotions as overwhelming and out of control." The lack of emotional awareness subscale (aware) contains 6 items with evidence of adequate internal consistency (α = .80; Gratz & Roemer). This subscale includes items such as "I am attentive to my feelings" and "I care about what I am feeling." The limited access to emotion regulation strategies subscale (strategies) also has evidence of internal consistency (α = .88; Gratz & Roemer). This subscale includes 8 items such as "when I'm upset, I start to feel very bad about myself" and "when I'm upset, it takes me a long time to feel better." The sixth dimension, the lack of emotional clarity subscale (clarity), includes 5 items and has evidence of acceptable internal consistency (α = .84; Gratz & Roemer). Items in this subscale include "I know exactly how I am feeling" and "I have difficulty making sense out of my feelings." There was also evidence for high internal consistency (α = .93; Gratz & Roemer) and adequate test-retest reliability for this subscale over a period of 4 to 8 weeks (total ρ =.88, nonacceptance ρ =.69, goals ρ =57, impulse ρ =.68, aware ρ =.89, strategies ρ = .89 and clarity ρ =.90; $p < .01$ for all) for the total score and subscales of the DERS.

Gratz and Roemer (2004) established convergent and discriminant validity through the investigation of the DERS in comparison to a commonly used measure of

emotion regulation (Negative Mood Regulation Scale) as well as other constructs of interest: experiential avoidance (measured by the Acceptance and Action Questionnaire), emotional expressivity (measured by the Emotional Expressivity Scale), deliberate self-harm (measured by the Deliberate Self-harm Inventory), and childhood abuse and perpetration (measured by the Abuse-perpetration Inventory). Hypothesized relationships between the DERs and these constructs were supported and the DERS was found to explain variance in these constructs above and beyond the NMR (Gratz & Roemer, 2004).

Procedures

Prior to proceeding with the study, the researcher received full approval from the Institutional Review Board (IRB). The researcher registered the study with ResearchMatch.org. The researcher utilized the ResearchMatch.org search builder to filter available volunteers based upon the study inclusion criteria, and the recruitment message was sent through ResearchMatch.org to non-identifiable participants who met the inclusion criteria. Individuals who were interested in learning about participation in the study (n = 733) released their contact information through ResearchMatch.org. The researcher emailed these individuals with the participation message containing directions to follow an online link that provided the informed consent document describing the nature of the study, potential risks, confidentiality, voluntary participation, optional incentive to participate, and researcher contact information for related questions. Participants who indicated agreement to participate after reading the informed consent were directed to the online survey. Participants (n = 203) completed the online survey

packet comprised of the ECR-R, DERS, SEBQ-2, NQ and demographic questionnaire. The survey packet included a total of 131 items that required an 8th grade reading level and took approximately 12-30 minutes or less to complete. The researcher followed this procedure until sufficient data were obtained.

Data Analysis

The current study is an exploratory cross-sectional correlational design that examined the relationships among the variables of attachment (ECR-R), emotion-regulation (DERS), and breathing (SEBQ-2 and NQ). The demographic data was assessed using descriptive statistics (including evaluation of frequency, distribution, and dispersion) to describe the sample. All data was managed by the student researcher and analyzed using SPSS version 19.0 or SAS version 9.3. Reliability analyses were conducted by calculating Cronbach's alpha for an estimate of internal consistency on the ECR-R, DERS, SEBQ-2, NQ, and SDS-16 for this sample. Also as preliminary analyses, assumptions for each analysis were tested. The correlations completed for question 1 were reviewed, and tolerance and VIF values were assessed to ensure the absence of multicollinearity issues. A residual analysis was used to ensure that the error variances were independent. To test for univariate and multivariate normality, skewness and kurtosis statistics as well as both univariate and multivariate Q-Q plots were assessed. Boxplots were generated for each variable to assess for univariate outliers. The Maximum D^2 was computed to evaluate for multivariate outliers. Outliers were examined to assess their impact on distribution as well as possible researcher error (e.g., data cleaning error). See Table 1 for a complete description of data analysis that were proposed for each research question and

were used in the analysis of the pilot study data. In the full study only univariate analyses were used due to violations of multivariate assumptions. See Table 4 in Chapter Four for a complete description of the analyses that were used for each research question in the full study.

Pilot Study

A pilot study was conducted to assess the procedures of the current study. With the exception of research question two, the research questions and hypotheses for the full study were used in the pilot study. In this section, the participants, instrumentation, procedures, and findings of the pilot study are described. This section concludes with details of the implications of the pilot study for the full study. The full report and findings are reported in Appendix R.

Participants

The sample for the pilot study consisted of 13 individuals between the ages of 22 and 32 with a mean age of 25.85 (SD = 3.21) who had experienced at least one adult romantic relationship. The majority of participants were female (*n* = 11; 84.6%) and the remaining 15.4% identified as male. Most participants' (*n* = 9; 69.2%) current romantic relationship had spanned 1 or more years with a mean of 3.11 years (SD = 1.65), two participants (15.4%) reported current relationships of 6 to 12 months, one participant (7.7%) reported less than 6 months, and one participant (7.7%) reported being currently single. Additional demographic information is reported in Appendix R.

Table 1

Descriptions of Research Questions and Proposed Data Analyses

Research Question	Hypothesis	Independent (predictor) variables	Dependent (criterion) variables	Data Analysis
1. What are the relationships among romantic attachment (anxiety and avoidance dimensions), emotion regulation difficulties, dysfunctional breathing symptoms, hyperventilation, and diagnosis of breathing problems in a young adult sample?	1.1 Greater symptoms of hyperventilation are related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion. 1.2 Greater symptoms of dysfunctional breathing are related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion. 1.3 Reported diagnosis of asthma and other breathing problems are related with greater symptoms of dysfunctional breathing and hyperventilation, difficulty regulating emotion, higher attachment anxiety and avoidance. 1.4 Greater romantic attachment anxiety and attachment avoidance related to greater difficulty regulating emotion.	Attachment Anxiety Attachment Avoidance Emotion Regulation total score and subscales Hyperventilation Dysfunctional Breathing Diagnosis of breathing problem		Pearson and point biserial correlations

Table 1 continued

Descriptions of Research Questions and Proposed Data Analyses

Research Question	Hypothesis	Independent (predictor) variables	Dependent (criterion) variables	Data Analysis
2. Are there differences in romantic attachment (anxiety and avoidance dimensions) and difficulty in emotion regulation among individuals who report symptoms of hyperventilation that indicate either clinically normal, mild, or significant symptoms of hyperventilation in a sample of young adults?	2.1 Participants who report clinically significant hyperventilation symptoms report higher scores on romantic attachment (anxiety and avoidance dimensions) and greater difficulty regulating emotion than participants who report mild or clinically normal hyperventilation symptoms. 2.2 Participants who report clinically normal hyperventilation symptoms report lower scores on romantic attachment (anxiety and avoidance dimensions) and difficulty regulating emotion than participants who report mild or clinically significant hyperventilation symptoms.	3 Hyperventilation categories: clinically normal, mild symptoms, clinically significant symptoms	Attachment Anxiety Attachment Avoidance Difficulty in Emotion Regulation	Multivariate analysis of variance
3. What percentage of the variance in romantic attachment (anxiety and avoidance dimensions) is accounted for by breathing symptoms (symptoms of hyperventilation and dysfunctional breathing) in a sample of young adults?	3.1 Symptoms of hyperventilation and dysfunctional breathing account for a significant portion of the variance in romantic attachment anxiety among a young adult sample. 3.2 Symptoms of hyperventilation and dysfunctional breathing account for a significant portion of the variance in romantic attachment avoidance among a young adult sample.	Hyperventilation Dysfunctional Breathing	Attachment Anxiety Attachment Avoidance	Simultaneous entry multivariate multiple regression

Table 1 continued

Descriptions of Research Questions and Proposed Data Analyses

Research Question	Hypothesis	Independent (predictor) variables	Dependent (criterion) variables	Data Analysis
4. What percentage of the variance in emotion regulation difficulty is accounted for by breathing symptoms (hyperventilation and dysfunctional breathing), and romantic attachment dimensions in a young adult sample?	4. Symptoms of hyperventilation, dysfunctional breathing, and romantic attachment dimensions account for a significant portion of the variance in global emotion regulation difficulty.	Attachment Anxiety Attachment Avoidance Hyperventilation Dysfunctional Breathing	Difficulty in Emotion Regulation	Simultaneous entry multiple regression
5. Are the relationships between breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty in a young adult sample moderated by romantic attachment (dimensions of avoidance and anxiety)?	5.1 Romantic attachment anxiety moderates the relationships between breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty among a young adult sample. 5.2 Romantic attachment avoidance moderates the relationships between breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty among a young adult sample.	Attachment Anxiety Attachment Avoidance Hyperventilation Dysfunctional Breathing	Difficulty in Emotion Regulation	Hierarchical multiple regression

Instrumentation

The instrumentation for the pilot study consisted of six measures: (a) demographic questionnaire, (b) Experiences in Close Relationship Revised (ECR-R; Fraley, Waller, & Brennan, 2000), (c) Nijmegen Questionnaire (NQ; van Doorn, Folgering, & Colla, 1982), (d) Self-evaluation of Breathing Questionnaire Version 2 (SEBQ-2; Courtney & Greenwood, 2009), (e) Difficulties in Emotion Regulation Scale (DERs; Gratz & Roemer, 2004), and the (f) Social Desirability Scale – 16 (Stöber, 2001). To further inform the full study, the final section of the survey consisted of four open-ended questions designed to assess the ease of survey completion including time to complete, clarity of directions and items, and any recommendations to increase the ease of survey completion. The instructions, items, and scoring information for these instruments are provided in Appendix D through H. The Cronbach's alpha levels for this sample are provided in Table 23 in Appendix R.

Procedures

Full approval was obtained from the Institutional Review Board (IRB) at The University of North Carolina at Greensboro (UNCG) for the current study. Once IRB approval was obtained the researcher registered the research study with ResearchMatch.org. Due to delays in the contract between ResearchMatch.org and the office of grants and contracts at UNCG, the researcher elected to utilize an alternative recruitment strategy for the pilot study. The researcher contacted the Chair of the Department of Counseling and Educational Development (CED) to request permission to utilize the Department's listserv to recruit participants. After permission was received,

the researcher emailed an invitation to participate in the study through the CED listserv for current masters and doctoral students. Individuals who chose to participate followed an online Qualtrics link that provided the informed consent document describing the nature of the study, potential risks, confidentiality, voluntary participation, and researcher contact information for related questions. Participants who indicated agreement to participate after completing the informed consent were redirected to the web-based survey. The participants then completed the online survey packet comprised of the ECR-R, DERS, SEBQ-2, NQ, SDS-16, demographic questionnaire, and the four open-ended feedback questions. According to participant self-report, the majority of participants completed the survey in 20 minutes or less (n = 10; 76.92%); the shortest completion time was 15 minutes (n = 3; 23.1%) and the longest was 35 minutes (n = 1; 7.7%), with a mean completion time of 20.93 minutes (SD = 5.94).

Data Analysis and Results

Data were collected using the secure online Qualtrics platform. Once data collection was completed the data were downloaded into an Excel spreadsheet and then SPSS version 19 and SAS 9.3 was used to analyze the data. Although the sample size was too small for meaningful interpretation of the results, data analyses were run for each research question and hypothesis of the full study with the exception of research question 2. Nearly all participants (n = 12; 92.31%) reported symptoms of hyperventilation above the cut-off indicative of clinically significant hyperventilation symptoms, so there were not sufficient group membership for the categories of clinically normal or mild symptoms

to conduct the data analysis for research question 2. The results of questions 1, 3, 4, and 5 are reported in Appendix R.

Adjustments for the Full Study

Though field-testing of the study procedures, including survey administration, was generally smooth, several adjustments were made in order to improve the ease of survey completion and improve the utilization of the Qualtrics platform. First, the authors of the ECR-R recommend that when the ECR-R is used in research the items should be randomized rather than being administered by scale (Fraley, 2013; Fraley et al., 2000). Due to researcher error in the use of Qualtrics, the ECR-R items were administered by scale in the pilot study and adjustments were made to ensure that these items were randomized in the survey administration of the full study. Also, though the survey administration remained the same, ResearchMatch.org was used to recruit participants. Accordingly, the recruitment message was adapted slightly to meet the criteria put forth by ResearchMatch.org as well as to improve readability. For instance, the criteria of reading level was dropped from the recruitment message.

There were also several changes made to the full study based on feedback from the dissertation committee. Since socially desirable responding was minimized by the design of sampling procedures the SDS-16 was removed from the survey packet. Also, a demographic question was added to address participant's current role as parent, caregiver, or neither. Additionally, it was planned that gender would be added to research question 2, however, there were not enough non-female participants to execute this analysis so research question two was not altered to include gender in the full study. Further, to

better capture the survey completion times experienced by pilot study participants, and changes made to the survey, the estimated time for survey completion was changed from 30 minutes to 12-30 minutes. The fully adapted recruitment message is shown in Appendix C. Additionally, several adjustments were made based upon the suggestions of the pilot study participants. The directions for the instruments were made more prominent with a larger font size and bold typeface and wording was clarified to be more appropriate for online administration. The word "check" in directions of the SEBQ-2, and NQ was changed to "indicate." The wording of demographic question related to current practices was altered to improve clarity and consistency with other items; accordingly, the term "breathwork" was replaced by "breath exercises."

CHAPTER IV

RESULTS

The purpose of this study was to explore the relationships among romantic attachment, breathing, and emotion regulation in a sample of young adults. In the current chapter, the demographic characteristics of the sample, descriptive statistics of the instruments used, the results of the preliminary analyses, and the results of analyses for each research question are described.

Description of the Sample

In order to obtain a geographically diverse sample of young adults between the ages 20-35 who have had at least one romantic relationship, ResearchMatch.org was used to recruit residents from Oregon, Texas, Illinois, Minnesota, Florida, and New York. ResearchMatch.org released to the researcher the contact information for 733 individuals who had consented to be contacted by email with information about the current study. The participation message was sent to these 733 individuals with a link to the online informed consent and survey, 203 participants accepted the informed consent and completed the survey. The complete demographic information of this sample is reported in Table 2. The average age of the participants was 27.64 (*SD* = 4.16). The majority of participants were female (*n* = 182, 89.7%), heterosexual (*n* = 170, 83.7%), and Caucasian (*n* = 168, 82.8%). About two thirds of the sample had completed a Bachelor's or higher

degree (*n* = 150, 73.9 %). Although the majority of the sample reported being in a current romantic relationship (*n* = 157, 77.3%), several participants (n = 3) reported multiple relationship statuses, including divorced and in a committed relationship (*n* = 1, .5%), divorced and in a committed relationship cohabitating (*n* = 1, .5%), and widowed and in a committed relationship (*n* = 1, .5%). The majority of participants reported they were not a caregiver or parent (*n* = 150, 73.8%).

Additionally, there were some characteristics of this sample that could impact participants' reports of breathing symptoms. A small portion of the sample reported a diagnosis of a breathing problem of asthma (*n* = 24, 11.8%) and two participants (1%) self-specified breathing problems related to allergies. Slightly less than half of the sample reported being overweight (*n* = 84, 41.3%). The majority of these participants reported being 10-25 pounds overweight (*n* = 43, 21.2%), while smaller numbers reported being 25-50 pounds overweight (*n* = 23, 11.3%), 51-75 pounds overweight (*n* = 11, 5.4%), and more than 76 pounds overweight (*n* = 7, 3.4%). Just over half of the participants reported regularly exercising (*n* = 115, 56.7%). Over two-thirds of the participants have not had voice training (*n* = 147, 72.4%) and more than half reported that they do not sing regularly (*n* = 121, 59.6%). Slightly less than half of the participants reported current engagement in a mind-body practice (*n* = 88, 43.3%) and the most commonly reported practice was yoga (*n* = 49, 24.1%). A small portion of the sample reported engaging in breath exercises (*n* = 25, 12.3%). A large portion of the sample reported that they are non-smokers (*n* = 161, 79.3%).

Table 2

Sample Demographics (*n* = 203)

Variable	Mean (Range)	*n*	%
Age	27.64 (20-35)		
Race/Ethnicity			
African-American/Black		7	3.4
Asian		3	1.5
Caucasian/White		168	82.8
Latino/a		12	5.9
Native American		2	1
Other (self-specified)			
Multi-racial		8	3.9
North-African		1	.5
Asian-Indian		1	.5
Italian-American		1	.5
Gender			
Female		182	89.7
Male		21	10.3
Sexual Orientation			
Heterosexual		170	83.7
Homosexual		12	5.9
Bisexual		17	8.4
Other		3	.1.5
Relationship Status			
Single		39	19.2
In a committed relationship		41	20.2
In a committed relationship co-habitating		49	24.1
Married/Civil partnership		65	32.0
Separated or divorced		10	4.9
Widowed		2	1
Other (self-specified)			
open long-distance		1	.5

Table 2 Continued

Variable	Mean (Range)	*n*	%
Diagnosis of Breathing Problem			
None		177	87.2
Asthma		24	11.8
Other (self-specified as allergies)		2	1
Heart problem			
None		186	91.6
Hypertension		4	2
Poor circulation		1	.5
Other		12	5.9
Weight			
Healthy weight		113	55.7
Underweight		6	3.0
Overweight by 10-25lbs		43	21.2
Overweight by 26-50lbs		23	11.3
Overweight by 51-75lbs		11	5.4
Overweight by 76lbs or more		7	3.4
Currently practices			
Breath exercises		25	12.3
Yoga		49	24.1
Mindfulness		39	19.2
Tai Chi		1	.5
Qigong		2	1
Pilates		12	5.9
Other		8	3.9
None of the above		115	56.7
Exercise regularly			
Yes		115	56.7
No		88	43.3

Table 2 Continued

Variable	Mean (Range)	*n*	%
Sings regularly			
Yes		82	40.4
No		121	59.6
Voice training			
Yes		56	27.6
No		147	72.4
Smoking Status			
Non-smoker		161	79.3
Past Smoker		23	11.3
Current Smoker		19	9.4
Caffeine consumption			
None		38	18.7
1 serving per day		68	33.5
2 servings per day		56	27.6
3-5 servings per day		36	17.7
6 or more servings per day		5	2.5
Education			
High school or equivalent		6	3.0
Vocational/technical school		2	1.0
Some college		41	20.2
Bachelor's degree		89	43.8
Master's degree		52	25.6
Doctoral degree		3	1.5
Professional degree		6	3.0
Other (self-specified)			
Associates Degree		3	1.5
Certificate		1	.5
Parent/Caregiver			
Not a parent or caregiver		150	73.8
Biological parent		42	20.7
Adoptive parent		1	.5
Step-parent		4	2.0
Parents partner		3	1.5

Descriptive Statistics

Each participant completed the online survey packet comprised of the ECR-R, DERS, SEBQ-2, NQ, and the demographic questionnaire, totaling 131 items. The complete descriptive statistics for the instruments used are provided in Table 3. The informed consent and survey data were collected online using the secure Qualtrics platform. The data was downloaded into an Excel spreadsheet. The data were inspected for missing values and missing values were found on three demographic questions, age (n = 3), sexual orientation (n = 1), and parenting/caregiving (n = 4). SPSS version 19 and SAS 9.3 were used to complete the data analyses. SAS 9.3 was used to test for the presence of multivariate outliers, univariate and multivariate normality. All other analyses were conducted with SPSS 19. Analyses were run for each research question and hypothesis of the current study (shown in Table 4).

Table 3

Means, Standard Deviations, Frequencies, Median, and Number of Items

Scale	mean	SD	median	frequency	# of items
ECR-R					
ANXIETY	57.70	23.38	56		18
AVOIDANCE	51.41	21.06	47		18
DERS					
NONACCEPTANCE	13.69	6.34	12		6
GOALS	14.20	5.10	14		5
IMPULSE	11.90	6.66	10		6
AWARENESS	12.76	4.19	12		6
STRATEGIES	16.97	7.23	15		8
CLARITY	10.7	3.77	10		5

Table 3 Continued

Scale	mean	SD	median	frequency	# of items
DERS					
TOTAL	80.22	24.94	74		36
SEBQ-2					
TOTAL	15.69	12.78	12		25
NQ					
TOTAL	14.77	9.94	13		15
Total < 11				80	
Total 11-22				84	
Total > 22				39	

To verify the assumptions of univariate and multivariate multiple regression analysis (e.g., normality, linearity, homoscedasticity, and multicollinearity) before proceeding with the analyses, preliminary analyses, including correlations, were conducted. There were no univariate assumption violations but there were violations of multivariate assumptions evidenced by problems with multivariate normality with both skewness and kurtosis. Additionally, an inspection of boxplots revealed univariate outliers, scores that were more than three standard deviations above the mean, on several scales. There was one outlier on the ECR-R Avoidance scale, two outliers on the DERS, nine on the SEBQ, and six on the NQ. All of the observations containing univariate outliers (n = 13) contained high scores on measures of either dysfunctional breathing (n =1), hyperventilation (n = 1), or both (n = 11). To assess for multivariate outliers, the squared standardized distance (D^2) was reviewed and two multivariate outliers were found. Each univariate and multivariate outlier was inspected to assess for researcher or participant error. There was no indication of researcher error. Several of the participants

had scores that were univariate outliers on both the SEBQ and the NQ that appeared to indicate consistent responding. For one observation, there were both univariate and multivariate outliers that may have been the result of participant error as evidenced by inconsistent responding. Specifically, the participant had a score more than three standard deviations above the mean (58) on the SEBQ (M = 15.69, SD = 12.78) yet a score of only 1 on the NQ (M = 14.77, SD = 9.94). Since the correlation between these two instruments is high (r = .72, p = .001), this discrepancy appears unlikely and may have been participant or Qualtrics error; however, it is impossible to verify the accuracy of the observation.

To further assess the impact of outliers on both the assumptions and the results, additional analyses were run, including correlations with all of the outliers omitted and with only the potentially erroneous entry omitted. The correlations for the data set with all outliers removed are shown in Table 6, and the correlations with only the potentially erroneous entry removed are in Table 7. When correlations were run with all univariate outliers removed (n = 190), there were some shifts in the magnitude of the relationships and these shifts were consistent with the similarities among these observations. Additionally, the relationship between the DERS scales of impulsivity and awareness was no longer significant (r = .14), and the relationship between symptoms of hyperventilation and breathing diagnosis became significant (r = .15, p < .05). When the correlations were run with only the potentially erroneous outlier removed (n = 202), there were no changes in significance though there were some shifts in the magnitude of relationships. The issues of skewness and kurtosis in multivariate normality were present

both with the full data set and when outliers were removed. A transformation of the data could be used to minimize the impact of outliers as well as to meet the assumptions of multivariate normality (Tabachnick & Fidell, 2013). However, there is debate in the literature both about what to do with identified outliers (Osborne & Overbay, 2004) and the use of transformations, in part because a transformation often leads to difficulty interpreting results (Tabachnick & Fidell, 2013). Thus, the data were not transformed and research questions 2 and 3 were analyzed using univariate analyses due to the violations of assumptions for multivariate analyses. See Table 4 for a full description of the data analyses used for each research question in the full study. With the possible exception of one, the outliers were thought to be legitimate and, accordingly, the data are most representative if the outliers are included (Orr, Sackett, & Dubois, 1991). Since the cause of these outliers is not known and to ensure that the inclusion of outliers did not cause significant results that would be nonsignificant with their exclusion, all analyses were performed with both the full data set and with the outliers excluded (Orr et al., 1991). Though the exclusion of outliers did not impact the significance of results, the effect sizes are larger with the full data set. This shift in magnitude is consistent given the similarities (high scores on dimensions of dysfunctional breathing) among observations containing univariate outliers. The results of the correlations with the full data set are reported in this chapter.

Table 4

Descriptions of Research Questions and Data Analyses

Research Question	Hypothesis	Independent (predictor) variables	Dependent (criterion) variables	Data Analysis
1. What are the relationships among romantic attachment (anxiety and avoidance dimensions), emotion regulation difficulties, dysfunctional breathing symptoms, hyperventilation, and diagnosis of breathing problems in a young adult sample?	1.1 Greater symptoms of hyperventilation are related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion. 1.2 Greater symptoms of dysfunctional breathing are related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion. 1.3 Reported diagnosis of asthma and other breathing problems are related with greater symptoms of dysfunctional breathing and hyperventilation, difficulty regulating emotion, higher attachment anxiety and avoidance. 1.4 Greater romantic attachment anxiety and attachment avoidance related to greater difficulty regulating emotion.	Attachment Anxiety Attachment Avoidance Emotion Regulation total score and subscales Hyperventilation Dysfunctional Breathing Diagnosis of breathing problem		Pearson and point biserial correlations

Table 4 continued

Descriptions of Research Questions and Data Analyses

Research Question	Hypothesis	Independent (predictor) variables	Dependent (criterion) variables	Data Analysis
2. Are there differences in romantic attachment (anxiety and avoidance dimensions) and difficulty in emotion regulation among individuals who report symptoms of hyperventilation that indicate either clinically normal, mild, or significant symptoms of hyperventilation in a sample of young adults?	2.1 Participants who report clinically significant hyperventilation symptoms report higher scores on romantic attachment (anxiety and avoidance dimensions) and greater difficulty regulating emotion than participants who report mild or clinically normal hyperventilation symptoms. 2.2 Participants who report clinically normal hyperventilation symptoms report lower scores on romantic attachment (anxiety and avoidance dimensions) and difficulty regulating emotion than participants who report mild or clinically significant hyperventilation symptoms.	3 Hyperventilation categories: clinically normal, mild symptoms, clinically significant symptoms	Attachment Anxiety Attachment Avoidance Difficulty in Emotion Regulation	(3) One-way analysis of variance with Bonferroni correction
3. What percentage of the variance in romantic attachment (anxiety and avoidance dimensions) is accounted for by breathing symptoms (symptoms of hyperventilation and dysfunctional breathing) in a sample of young adults?	3.1 Symptoms of hyperventilation and dysfunctional breathing account for a significant portion of the variance in romantic attachment anxiety among a young adult sample. 3.2 Symptoms of hyperventilation and dysfunctional breathing account for a significant portion of the variance in romantic attachment avoidance among a young adult sample.	Hyperventilation Dysfunctional Breathing	Attachment Anxiety Attachment Avoidance	(2) Simultaneous entry multiple regression with Bonferroni correction

Table 4 continued

Descriptions of Research Questions and Data Analyses

Research Question	Hypothesis	Independent (predictor) variables	Dependent (criterion) variables	Data Analysis
4. What percentage of the variance in emotion regulation difficulty is accounted for by breathing symptoms (hyperventilation and dysfunctional breathing), and romantic attachment dimensions in a young adult sample?	4. Symptoms of hyperventilation, dysfunctional breathing, and romantic attachment dimensions account for a significant portion of the variance in global emotion regulation difficulty.	Attachment Anxiety Attachment Avoidance Hyperventilation Dysfunctional Breathing	Difficulty in Emotion Regulation	Simultaneous entry multiple regression
5. Are the relationships between breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty in a young adult sample moderated by romantic attachment (dimensions of avoidance and anxiety)?	5.1 Romantic attachment anxiety moderates the relationships between breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty among a young adult sample. 5.2 Romantic attachment avoidance moderates the relationships between breathing symptoms (hyperventilation and dysfunctional breathing) and emotion regulation difficulty among a young adult sample.	Attachment Anxiety Attachment Avoidance Hyperventilation Dysfunctional Breathing	Difficulty in Emotion Regulation	Hierarchical multiple regression

Table 5

Cronbach's Alphas and Correlations with Full Data Set (*n* = 203)

		1	2	3	4	5	6	7	8	9	10	11	12
1.	**A_ANX**	.95											
2.	**A_AVD**	.51**	.95										
3.	**ER_CLR**	.46**	.43**	.86									
4.	**ER_NOA**	.48**	.38**	.55**	.93								
5.	**ER_GOL**	.41**	.08	.44**	.38**	.92							
6.	**ER_IMP**	.51**	.17*	.61**	.51**	.67**	.92						
7.	**ER_AWR**	.24**	.41**	.63**	.40**	.08	.25**	.82					
8.	**ER_STG**	.60**	.25**	.58**	.59**	.63**	.77**	.32**	.92				
9.	**ER_TOT**	.60**	.36**	.79**	.77**	.72**	.85**	.53**	.89**	.96			
10.	**DB**	.32**	.20**	.34**	.41**	.33**	.42**	.28**	.42**	.49**	.94		
11.	**HYP**	.36**	.28**	.37**	.42**	.28**	.37**	.22**	.39**	.45**	.72**	.90	
12.	**B_DX**	-.03	-.04	-.08	-.04	-.06	-.08	-.02	-.05	-.07	.16*	.13	-

Cronbachs alphas are reported on the diagonal. *Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed). Abbreviations: A_ANX, Romantic Attachment Anxiety; A_AVD, Romantic Attachment Avoidance; ER_CLAR, Emotion Regulation Clarity; ER_NOA, Emotion Regulation Nonacceptance; ER_GOL, Emotion Regulation Goals; ER_IMP, Emotion Regulation Impulsivity; ER_AWR, Emotion Regulation Awareness; ER_STG, Emotion Regulation Strategies; ER_TOT, Global Emotion Regulation; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation; B_DX, Breathing problem diagnosis.

Table 6

Correlations with all Outliers Removed (*n* = 190)

	1	2	3	4	5	6	7	8	9	10	11	12
1. A_ANX	1											
2. A_AVD	.55**	1										
3. ER_CLR	.37**	.45**	1									
4. ER_NOA	.47**	.40**	.52**	1								
5. ER_GOL	.34**	.05	.34**	.30**	1							
6. ER_IMP	.44**	.18*	.51**	.45**	.63**	1						
7. ER_AWR	.20**	.43**	.60**	.35**	-.03	.14	1					
8. ER_STG	.56**	.26**	.51**	.55**	.61**	.74**	.25**	1				
9. ER_TOT	.56**	.38**	.75**	.75**	.68**	.81**	.47**	.88**	1			
10. DB	.24**	.25**	.24**	.34**	.21**	.27**	.21**	.30**	.37**	1		
11. HYP	.27**	.32**	.24**	.35**	.15*	.24**	.17*	.27**	.33**	.79**	1	
12. B_DX	-.03	-.05	-.07	-.05	-.06	-.07	-.01	-.07	-.07	.22**	.15*	1

*Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed). Abbreviations: A_ANX, Romantic Attachment Anxiety; A_AVD, Romantic Attachment Avoidance; ER_CLAR, Emotion Regulation Clarity; ER_NOA, Emotion Regulation Nonacceptance; ER_GOL, Emotion Regulation Goals; ER_IMP, Emotion Regulation Impulsivity; ER_AWR, Emotion Regulation Awareness; ER_STG, Emotion Regulation Strategies; ER_TOT, Global Emotion Regulation; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation; B_DX, Breathing problem diagnosis.

Table 7

Correlations with One Potentially Erroneous Outlier Removed (*n* = 202)

		1	2	3	4	5	6	7	8	9	10	11	12
1.	**A_AVD**	.51**	1										
2.	**ER_CLR**	.48**	.43**	1									
3.	**ER_NOA**	.48**	.38**	.55**	1								
4.	**ER_GOL**	.41**	.08	.44**	.38**	1							
5.	**ER_IMP**	.51**	.17*	.61**	.51**	.68**	1						
6.	**ER_AWR**	.24**	.41**	.63**	.40**	.08	.25**	1					
7.	**ER_STG**	.60**	.24**	.58**	.59**	.63**	.78**	.32**	1				
8.	**ER_TOT**	.60**	.35**	.79**	.77**	.72**	.85**	.53**	.89**	1			
9.	**DB**	.33**	.20**	.35**	.41**	.33**	.41**	.27**	.42**	.48**	1		
10.	**HYP**	.37**	.29**	.37**	.43**	.28**	.39**	.23**	.40**	.47**	.77**	1	
11.	**B_DX**	-.03	-.04	-.08	-.03	-.06	-.08	-.02	-.05	-.07	.17*	.12	1

*Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed). Abbreviations: A_ANX, Romantic Attachment Anxiety; A_AVD, Romantic Attachment Avoidance; ER_CLAR, Emotion Regulation Clarity; ER_NOA, Emotion Regulation Nonacceptance; ER_GOL, Emotion Regulation Goals; ER_IMP, Emotion Regulation Impulsivity; ER_AWR, Emotion Regulation Awareness; ER_STG, Emotion Regulation Strategies; ER_TOT, Global Emotion Regulation; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation; B_DX, Breathing problem diagnosis.

Though there were some high correlations among some variables, there were no significant issues of multicollinearity in the preliminary analysis of tolerance and VIF values. Multicollinearity issues also were evaluated in the analysis of each research question. Issues of multicollinearity arose in research question 5 as reported with the results of the analysis. For this sample, acceptable reliability was found for each instrument. The means, standard deviations (or frequencies, as appropriate), medians (due to the presence of outliers) are reported in Table 3. The Cronbach's alpha levels for each variable are reported with the correlations with the full data set shown in Table 5.

Research Question One

The first research question (What are the relationships among romantic attachment [anxiety and avoidance dimensions], emotion regulation difficulties, dysfunctional breathing symptoms, hyperventilation, and diagnosis of breathing problems in a young adult sample?) had four hypotheses. Pearson product-moment (for continuous variables), and point-biserial (for dichotomous variables) correlations were used in the analysis of hypotheses 1.1, 1.2, 1.3, and 1.4 are shown in Table 5.

The first hypothesis was that greater symptoms of hyperventilation would be related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion. There were significant positive relationships between symptoms of hyperventilation, NQ total score, and difficulty regulating emotion, DERS total score ($r = .45$, $p < .001$), and each of the DERS scales, Clarity ($r = .37$, $p < .01$), Nonacceptance ($r = .42$, $p < .01$), Goals ($r = .28$, $p < .01$), Impulsivity ($r = .37$, $p < .01$), Awareness ($r = .22$, $p < .01$), and Strategies ($r = .39$ $p < .01$). Additionally, there

were significant positive relationships between symptoms of hyperventilation and both romantic attachment anxiety ($r = .36$, $p < .01$) and romantic attachment avoidance ($r = .28$, $p < .01$).

The second hypothesis was that greater symptoms of dysfunctional breathing would be related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion. There were significant positive relationships between symptoms of dysfunctional breathing (SEBQ-2 total score) and difficulty regulating emotion, DERS total score ($r = .49$, $p < .01$), as well as each of the DERS scales, Clarity ($r = .34$, $p < .01$), Nonacceptance ($r = .41$, $p < .01$), Goals ($r = .33$, $p < .01$), Impulsivity ($r = .42$, $p < .01$), Awareness ($r = .28$, $p < .01$), and Strategies ($r = .42$, $p < .01$). Additionally, there were significant positive relationships between symptoms of dysfunctional breathing and both romantic attachment anxiety ($r = .32$, $p < .01$) and romantic attachment avoidance ($r = .20$, $p < .01$).

The third hypothesis was that reported diagnosis of asthma and other breathing problems would be related with greater symptoms of dysfunctional breathing and hyperventilation, difficulty regulating emotion, higher attachment anxiety and avoidance. The two participants who reported a breathing diagnosis other than none (n = 177) or asthma (n = 24) specified allergies, and were not included in the correlation of breath diagnosis due to the small sample size and unclear connection to diagnosis of a breathing problem (i.e., severity of allergies). There was a significant positive relationship, then, between breathing diagnosis (none or asthma) and symptoms of dysfunctional breathing, the SEBQ-2, ($r = .16$, $p < .05$).

The fourth and final hypothesis for research question one was that greater romantic attachment anxiety and attachment avoidance would be related to greater difficulty regulating emotion. There were significant positive relationships between romantic attachment anxiety and difficulty regulating emotion, the DERS total score ($r = .60$, $p < .001$), as well as each of the DERS scales, Clarity ($r = .46$, $p < .01$), Nonacceptance ($r = .48$, $p < .05$), Goals ($r = .41$, 06, $p < .01$), Impulsivity ($r = .51$, $p < .01$), Awareness ($r = .24$, $p < .01$), and Strategies ($r = .60$, $p < .01$). Additionally, there were significant positive relationships between attachment avoidance and DERS total score ($r = .36$, $p < .01$), as well as five of the DERS scales, Clarity ($r = .43$, $p < .01$), Nonacceptance ($r = .38$, $p < .01$), Impulsivity ($r = .17$, $p < .05$), Awareness ($r = .41$, $p < .01$), and Strategies ($r = .25$, $p < .01$).

Research Question Two

The second research question (Are there differences in romantic attachment [anxiety and avoidance dimensions] and difficulty in emotion regulation among individuals who report symptoms of hyperventilation that indicate either clinically normal, mild, or significant symptoms of hyperventilation in a sample of young adults?) was analyzed with three separate one-way analyses of variance (ANOVA) to test the two hypotheses because the assumptions for multivariate normality were not met. To minimize family-wise error than can occur with when using multiple analyses, a Bonferroni correction was used and the significance level set to $p < .017$. The first hypothesis was that participants who reported clinically significant hyperventilation symptoms would report higher scores on romantic attachment (anxiety and avoidance

dimensions) and greater difficulty regulating emotion than participants who report mild or clinically normal hyperventilation symptoms. The second hypothesis was that participants who reported clinically normal hyperventilation symptoms would report lower scores on romantic attachment (anxiety and avoidance dimensions) and difficulty regulating emotion than participants who reported mild or clinically significant hyperventilation symptoms.

A one-way ANOVA with Bonferroni correction was used to test parts of both hypotheses specific to attachment anxiety, that participants who reported clinically significant symptoms of hyperventilation would report higher levels of attachment anxiety than those who reported mild or normal symptoms, and that those who reported normal symptoms would report lower scores of attachment anxiety. There were significant differences among the means of the three groups ($F_{2,200}$ =14.23, $p < .001$). As hypothesized, visual inspection of the group means revealed that the participants who reported clinically normal symptoms of hyperventilation reported the lowest scores on attachment anxiety (M = 51.75, SD = 20.97) and the participants who reported clinically significant symptoms of hyperventilation reported the highest scores on attachment anxiety (M = 74.10, SD = 22.11). The results of a post hoc Bonferroni test indicated that the mean difference in attachment anxiety between individuals who reported normal or mild symptoms was not significant (MD = 4.01, p =.73). The mean attachment anxiety scores for individuals who reported clinically significant symptoms of hyperventilation was significantly different from both those who reported normal (MD = 22.35, $p < .001$) and those who reported mild symptoms of hyperventilation (MD = 18.34, $p < .001$).

Table 8

Hyperventilation Categories and Romantic Attachment Anxiety Score

Symptoms of Hyperventilation	*n*	*Attachment Anxiety*		95% CI	
		M	*SD*	Lower Bound	Upper Bound
Normal	80	51.75	20.97	47.08	56.42
Mild	84	55.76	22.63	50.85	60.67
Significant	39	74.10	22.11	66.94	81.27

Table 9

One-way ANOVA with Hyperventilation and Romantic Attachment Anxiety

Source	*SS*	*Df*	*MS*	*F*
Between	13640.44	2	6820.22	14.23
Within	95835.83	200	479.18	
Total	109476.27	202		

Table 10

Post-hoc Bonferroni Test for One-way ANOVA for Hyperventilation and Romantic Attachment Anxiety

Categories		*Cohen's d*	*MD*	*SE*	*p*
Mild	Normal	-.18	4.01	3.42	.726
Significant	Normal	-1.04	22.35	2.28	.000
Significant	Mild	-.82	18.34	4.24	.000

A second one-way ANOVA with Bonferroni correction was conducted to test parts of both hypotheses related to attachment avoidance, that participants who reported clinically significant symptoms of hyperventilation would report higher levels of attachment avoidance than those who reported mild or normal symptoms, and that those who reported normal symptoms would report lower scores of attachment avoidance than those who report mild or significant symptoms. There were significant differences among the means of the three groups ($F_{2,200} = 10.43$, $p < .001$). As hypothesized, visual inspection of the group means revealed that the participants who reported clinically normal symptoms of hyperventilation reported the lowest scores on attachment avoidance ($M = 46.51$, $SD = 17.27$) and the participants who reported clinically significant symptoms of hyperventilation reported the highest scores on attachment avoidance ($M = 64.23$, $SD = 24.81$). The results of a post hoc Bonferroni test indicated that the mean difference in attachment avoidance between individuals who reported normal symptoms and those who reported mild symptoms of hyperventilation was nonsignificant ($MD = 3.62$, $p = .755$). The mean in attachment avoidance for individuals who reported clinically significant symptoms of hyperventilation was significantly different from both those who reported normal ($MD = 17.72$, $p < .001$) and those who reported mild symptoms of hyperventilation ($MD = 14.10$, $p = .001$).

Table 11

Hyperventilation Categories and Romantic Attachment Avoidance Score

Symptoms of Hyperventilation	*n*	*Attachment Anxiety*		95% CI	
		M	*SD*	Lower Bound	Upper Bound
Normal	80	46.51	17.27	42.67	50.36
Mild	84	50.13	20.30	45.73	54.54
Significant	39	64.23	24.81	56.19	72.27

Table 12

One-way ANOVA with Hyperventilation and Romantic Attachment Avoidance

Source	*SS*	*Df*	*MS*	*F*
Between	8466.77	2	4233.39	10.43
Within	81152.47	200	405.76	
Total	89619.24	202		

Table 13

Post-hoc Bonferroni Test for One-way ANOVA for Hyperventilation and Romantic Attachment Avoidance

Categories		*Cohen's d*	*MD*	*SE*	*p*
Mild	Normal	-0.19	3.62	3.15	.755
Significant	Normal	-0.83	17.72	3.93	.000
Significant	Mild	-0.62	14.10	3.90	.001

A third one-way ANOVA with Bonferroni correction was conducted to test parts of both hypotheses for research question 2, that participants who reported clinically significant symptoms of hyperventilation would report higher levels of difficulty regulating emotion than those who reported mild or normal symptoms, and that those who reported normal symptoms would report lower scores of difficulty regulating emotion than those who reported mild or significant symptoms. There were significant differences among the means of the three groups ($F_{2,200} = 21.51$, $p < .001$). As hypothesized, a visual inspection of the group means indicated that the participants who reported clinically normal symptoms of hyperventilation reported the lowest scores on difficulty regulating emotion ($M = 69.79$, $SD = 19.37$) and the participants who reported clinically significant symptoms of hyperventilation reported the highest scores on difficulty regulating emotion ($M = 98.74$, $SD = 27.24$). The results of a post hoc Bonferroni test indicated that the mean difference in difficulty regulating emotion between individuals who report normal symptoms and those who reported mild symptoms of hyperventilation was significant ($MD = 11.76$, $p = .003$). The mean scores of difficulty regulating emotion for individuals who reported clinically significant symptoms of hyperventilation was significantly different from both those who reported normal ($MD = 28.96$, $p < .001$) and those who reported mild symptoms of hyperventilation ($MD = 17.20$, $p < .001$).

Table 14

Hyperventilation Categories and Emotion Regulation Difficulty Score

Symptoms of Hyperventilation	*n*	*Emotion Regulation Difficulty*		95% CI	
		M	*SD*	Lower Bound	Upper Bound
Normal	80	69.79	19.37	65.48	74.10
Mild	84	81.55	23.43	76.46	86.63
Significant	39	98.74	27.24	89.92	107.57

Table 15

One-way ANOVA with Hyperventilation and Difficulty Regulating Emotion

Source	*SS*	*Df*	*MS*	*F*
Between	22236.83	2	11118.42	21.51
Within	103385.63	200	516.93	
Total	125622.46	202		

Table 16

Post-hoc Bonferroni Test for One-way ANOVA for Hyperventilation and Difficulty Regulating Emotion

Categories		*Cohen's d*	*MD*	*SE*	*p*
Mild	Normal	-0.55	11.76	3.55	.003
Significant	Normal	-1.22	28.96	4.44	.000
Significant	Mild	-0.68	17.20	4.41	.000

Research Question Three

Two simultaneous entry multivariate multiple regression with Bonferroni correction ($p < .025$) were used in the analysis of research question 3 to test the hypotheses that significant variance in attachment anxiety and attachment avoidance is accounted for by symptoms of hyperventilation and dysfunctional breathing in a young adult sample. The multivariate multiple regression was not used because the assumption of multivariate normality was violated.

The first regression tested attachment anxiety (the ECR-R anxiety scale) on symptoms of dysfunctional breathing and hyperventilation and was significant (adjusted $R^2 = .13$, $F_{2,200} = 16.28$, $p < .001$). Symptoms of hyperventilation (NQ total score) was the only significant predictor of attachment anxiety in the model ($t = 2.86$, $p = .005$). The full results for the analysis are shown in table 17.

Table 17

Multiple Regression with Criterion Variable of Romantic Attachment Anxiety

Predictor Variable	β	*t*	*p*	ΔR^2	Adjusted ΔR^2
Fit of the Model			.000	.14	.13
DB	.13	1.36	.175		
HYP	.27	2.86	.005		

Abbreviations: DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation.

Table 18

Multiple Regression with Criterion Variable of Romantic Attachment Avoidance

Predictor Variable	β	*t*	*p*	ΔR^2	Adjusted ΔR^2
Fit of the Model			.000	.08	.07
DB	-.002	-.02	.984		
HYP	.28	2.89	.004		

Abbreviations: DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation.

A second simultaneous entry multiple regression was used to test attachment avoidance (the ECR-R avoidance scale) on symptoms of dysfunctional breathing and hyperventilation and was significant (adjusted R^2 = .07, $F_{2,200} = 8.60$, $p < .001$). Symptoms of hyperventilation (NQ total score) was the only significant predictor of attachment avoidance in the model ($t = 2.89$, $p = .004$). The full results for this analysis are shown in table 18.

Research Question Four

The fourth research question (What percentage of the variance in emotion regulation difficulty is accounted for by breathing symptoms [hyperventilation and dysfunctional breathing], and romantic attachment dimensions in a young adult sample?) was examined using a simultaneous entry multiple regression to analyze the hypothesis that hyperventilation, dysfunctional breathing, and romantic attachment dimensions of anxiety and avoidance would account for a significant portion of the variance in difficulty regulating emotion. The regression testing difficulty regulating emotion on attachment anxiety, attachment avoidance, symptoms of dysfunctional breathing and

hyperventilation was significant (adjusted R^2 = .45, $F_{4,198} = 42.55$, $p < .001$) and accounted for 45% of the variance in difficult regulating emotion. Romantic attachment anxiety (ECR-R anxiety scale; β = .47, $t = 7.35$, $p < .001$) and symptoms of dysfunctional breathing (SEBQ total score; β = .27, $t = 3.56$, $p < .001$) were both significant predictors of difficulty regulating emotions. The full results are shown in table 19.

Table 19

Multiple Regression with Criterion Variable of Difficulty Regulating Emotion

Predictor Variable	β	*t*	*p*	ΔR^2	Adjusted ΔR^2
Fit of the Model			.000	.46	.45
A_ANX	.47	7.35	.000		
A_AVD	.04	.66	.508		
DB	.27	3.56	.000		
HYP	.08	1.03	.306		

Abbreviations: A_ANX, Romantic Attachment Anxiety; A_AVD, Romantic Attachment Avoidance; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation.

Research Question Five

A hierarchical multiple regression was used to analyze research question 5 and test the following hypotheses: romantic attachment anxiety moderates the relationships between reported symptoms of hyperventilation and dysfunctional breathing, and emotion regulation difficulty; and romantic attachment avoidance moderates the relationships between symptoms of hyperventilation and dysfunctional breathing, and emotion regulation difficulty. To minimize multicollinearity issues and maximize the ease of interpretation, moderator and independent variables were centered prior to

calculating interaction terms (Frazier, Tix, & Barron, 2004). In the first hierarchical block, the two hypothesized moderators, romantic attachment anxiety and romantic attachment avoidance, were included. In the second block, the two independent variables, dysfunctional breathing and hyperventilation, were added to the regression model. Finally, in the third block the four interaction terms, attachment anxiety and hyperventilation, attachment anxiety and dysfunctional breathing, attachment avoidance and hyperventilation, and attachment avoidance and dysfunctional breathing, were added to the model predicting emotion regulation difficulty. Entering the interaction terms in the final block after the blocks with the predictor and moderator variables helps to reduce the inflated Type I error that can occur when testing multiple moderators in a single model (Frazier et al., 2004). Because the third model accounted for a significant portion of the variance in emotion regulation difficulty (adjusted R^2 = .45, $F_{8,194} = 21.49$, $p < .001$) it is recommended that the results of the first two steps are disregarded (Edwards, 2008). In step three, only the individual contributions of attachment anxiety (β = .46, $t = 7.04$, $p < .001$) and dysfunctional breathing (β = .26, $t = 3.21$, $p = .002$) were significant predictors of difficulty regulating emotion. Further, the change in R^2 when the interaction terms were added to the model was nonsignificant (R^2_{change} = .008, p = .598). The interaction terms were nonsignificant predictors and the hypotheses relative to question five were not supported.

There were issues of multicollinearity with two interaction terms, as evidenced by Variance Inflation Factor (VIF) values slightly above the acceptable cut-off (4) for hyperventilation and romantic attachment anxiety (VIF = 4.97), and dysfunctional

breathing and romantic attachment anxiety (VIF = 5.02). There were medium to high correlations between romantic attachment anxiety and romantic attachment avoidance (r = .51, p = .001) and between hyperventilation and dysfunctional breathing (r = .72, p = .001). The VIF values are reported in Table 20 and a correlation matrix of the variables and interaction terms are reported in Table 21. To assess the impact of multicollinearity on the results, the model was run without the interaction with the highest VIF (dysfunctional breathing and romantic attachment anxiety). The results with this interaction term omitted in step three were largely consistent with the results with the interaction term included. The largest change was that the VIF values were all within the acceptable range. Attachment anxiety and dysfunctional breathing remained the only unique predictors of difficulty regulating emotion. The individual contribution of dysfunctional breathing was slightly increased (β = .28, $t = 3.39$, $p = .001$). The interaction terms were nonsignificant and, accordingly, the hypotheses relative to question five were not supported. The results of the model with this interaction omitted (dysfunctional breathing and romantic attachment anxiety) are reported in table 20. Also, with the interaction terms included in the regression equation, the standardized β are not thought to be properly standardized, so both the standardized and unstandardized β are reported in Table 20. These slope coefficients should be interpreted with caution (Frazier et al., 2004). The full results of this analysis are shown in table 20.

Table 20

Hierarchical Multiple Regression with Difficulty Regulating Emotions

Predictor Variable	β (unstandardized)	β	*t*	*p*	ΔR^2	Adjusted ΔR^2	VIF
Fit of Model 1				.000	.37	.36	
A_ANX	.61	.57	8.69	.000			1.36
A_AVD	.08	.06	.98	.330			1.36
Fit of Model 2				.000	.46	.45	
A_ANX	.50	.47	7.35	.000			1.48
A_AVD	.05	.04	.66	.508			1.38
DB	.53	.27	3.56	.000			2.11
HYP	.20	.08	1.03	.306			2.20
Fit of Model 3				.000	.47	.45	
A_ANX	.50	.46	7.04	.000			1.58
A_AVD	.06	.05	.71	.480			1.60
DB	.51	.26	3.21	.002			2.46
HYP	.15	.06	.70	.488			2.57
A_ANX*DB	.01	.17	1.46	.147			5.02
A_ANX*HYP	-.01	-.08	-.97	.332			2.57
A_AVD*DB	-.01	-.11	-.93	.354			4.97
A_AVD*HYP	.01	.08	.89	.375			2.83
Fit of Model 3 with A_ANX*DB excluded				.000	46	.45	
A_ANX	.49	.46	6.99	.000			1.58
A_AVD	.05	.04	.64	.521			1.60
DB	.54	.28	3.39	.001			2.43
HYP	.15	.06	.71	.481			2.57
A_ANX*HYP	.00	.04	.63	.527			1.29
A_AVD*DB	.00	-.02	-.30	.762			1.96
A_AVD*HYP	.00	.03	.31	.759			2.34

Abbreviations: A_ANX, Romantic Attachment Anxiety; A_AVD, Romantic Attachment Avoidance; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation

Table 21

Correlations of Centered Variables and Interaction Terms

	1	2	3	4	5	6	7	8
1. ANX	1							
2. AVD	.51**	1						
3. DB	.32**	.20**	1					
4. HYP	.36**	.28**	.72**	1				
5. ANX*DB	.15*	-.05	.33**	.27**	1			
6. ANX*HYP	-.05	.11	.05	-.03	.28**	1		
7. AVD*DB	.20**	.01	.27**	.32**	.84**	.16*	1	
8. AVD*HYP	.02	.27**	-.03	.14*	.15*	.65**	.28**	1

*Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level. Abbreviations: ANX, Romantic Attachment Anxiety; AVD, Romantic Attachment Avoidance; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation.

Summary of Results

In this chapter, the results of the study were presented. Additionally, the description of the sample, descriptive statistics, and reliability coefficients were reported. Based on an analysis of Cronbach's alpha, all instruments were shown to have acceptable reliability for this sample. The data analysis and results were presented for each hypothesis. There were significant positive relationships among attachment anxiety, attachment avoidance, difficulty regulating emotion, symptoms of hyperventilation, and symptoms of dysfunctional breathing. There were significant differences in scores of romantic attachment anxiety, romantic attachment avoidance, and difficulty in emotion regulation among individuals who reported symptoms of hyperventilation that indicated

either clinically normal, mild, or significant symptoms. A significant portion of the variance in both romantic attachment avoidance and romantic attachment anxiety was accounted for by symptoms of hyperventilation. The model testing attachment avoidance, attachment anxiety, dysfunctional breathing, and hyperventilation on difficulty regulating emotion accounted for 45% of the variance in emotion regulation difficulty with unique contributions from attachment anxiety and dysfunctional breathing. The relationship between dysfunctional breathing, hyperventilation, and difficulty regulating emotion was not moderated by either romantic attachment anxiety nor romantic attachment avoidance. In chapter five these results are discussed in the context of the relevant literature and implications for counselors, counselor educators, and researchers.

CHAPTER V

DISCUSSION

The current study was designed to investigate the relationships among attachment, emotion regulation, and breathing. Although there was existing empirical evidence for relationships between attachment and emotion regulation as well as breathing and emotion regulation, the three constructs had not been studied together, nor had the relationships between breathing and attachment been previously investigated. The research questions and purpose of the study were discussed in Chapter One. The second chapter reviewed the relevant literature. The procedures and data analyses were outlined in Chapter Three and the results were presented in Chapter Four. In the current chapter, the sample and results are discussed in the context of the relevant literature. The limitations of the study; implications for counselors, counselor educators, and future research; and conclusions also are presented in this chapter.

Summary of the Sample

Of the 733 individuals registered as potential volunteers through ResearchMatch.org who consented to be contacted and were sent an email with a link to the online informed consent and survey, 203 participants accepted the informed consent and completed the survey. The participants were all between the ages of 20 - 35, reported having at least one adult romantic relationship, and were residents of Oregon, Texas, Illinois, Minnesota, Florida, or New York. Most participants were female, heterosexual,

Caucasian, had completed a Bachelor's or higher degree, were non-smokers, reported being in a current romantic relationship, and were neither parents nor caregivers. Only a small portion of the sample reported a diagnosis of asthma. Slightly less than half of the sample reported being overweight. Less than one-third of the participants reported voice training and a small portion of the sample reported engaging in breath exercises. It is noteworthy that this sample is not representative of the general population. For instance, according to the United States Census Bureau's quick facts (2014), the general population has a lower portion of females (54.1%), far fewer individuals who have completed a Bachelor's degree or higher (28.5%), and a larger portion of African American (13.1%), Asian (5.1%), and Hispanic (16.9%) individuals than was true for the sample for this study. As such, the generalizability of the results of this study may be limited.

Discussion of Hypothesis Testing

Overall, the results of the present study offer support for both the associations identified in the existing literature as well as many of the hypothesized relationships among attachment, breathing, and emotion regulation. In the following section the results are discussed for each hypothesis in the current study.

Research Question 1

Hypothesis 1.1. There were significant positive bivariate relationships between symptoms of hyperventilation and each of the following: difficulty regulating emotion (total score as well as all of the dimensions of difficulty of Clarity, Nonacceptance, Goals, Impulsivity, Awareness, and Strategies), romantic attachment anxiety, and romantic attachment avoidance. These results support hypothesis 1.1 that greater

symptoms of hyperventilation are related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion. The strongest relationship was a moderate correlation between hyperventilation and the total score for difficulty regulating emotion ($r = .45$, p <.01). Though the association between self-reported symptoms of hyperventilation and self-reported difficulty regulating emotion is a novel contribution, this finding is consistent with related literature in which researchers have reported that breath related factors are associated with discrete emotions (Philippot et al., 2002), overall mood (Butler et al., 2006; Ritz, 2004), and down-regulation of emotion (Scano, Gigliotti, Stendardi, & Gagliardi, 2013). From this combination of findings, it seems increasingly apparent that hyperventilation is related to emotional well-being.

The finding of significant relationships between hyperventilation and both attachment dimensions is another novel contribution to the literature. The relationship between hyperventilation and romantic attachment anxiety ($r = .36$, $p < .01$) was moderate and the strength of the relationship between hyperventilation and romantic attachment avoidance was small ($r = .28$, $p < .01$). Two possibilities exist here. First, it is possible that attachment anxiety is slightly more closely related to hyperventilation than is attachment avoidance. It also seems plausible, though, that this difference is more a function of a previous finding that greater attachment avoidance is associated with greater disassociation from, and thus lower self-awareness of, physiological responses (Diamond et al., 2006). This tendency could result in lower reporting of symptoms of

hyperventilation and dysfunctional breathing among individuals with greater attachment avoidance than individuals who report greater attachment anxiety.

Hypothesis 1.2. There were significant positive bivariate relationships between symptoms of dysfunctional breathing and each of the following: difficulty regulating emotion (total score as well as all of the dimensions of Clarity, Nonacceptance, Goals, Impulsivity, Awareness, and Strategies), romantic attachment anxiety, and romantic attachment avoidance. These results support hypothesis 1.2, that greater symptoms of dysfunctional breathing are related to greater romantic attachment anxiety, romantic attachment avoidance, and difficulty regulating emotion. Paralleling the results for hypothesis 1.1, the strongest relationship was a moderate correlation between symptoms of dysfunctional breathing and the total score for difficulty regulating emotion (r = .49, p < .01). This is interesting because though the relationships between DB and both attachment avoidance and attachment anxiety were significant, the relationships were weaker than those between hyperventilation and attachment dimensions. This may indicate that while DB and hyperventilation have essentially the same relationship with difficulty regulating emotion, breathing factors associated with hyperventilation may be more closely related to attachment processes than other dimensions of dysfunctional breathing. The pattern of differences in relationship strength was consistent with the findings in Hypothesis 1.1, the strength of the relationship between DB and attachment anxiety was moderate (r = .32, p < .01) while the strength of relationship between DB and attachment avoidance was small (r = .20, p < .01). As previously discussed, it is

possible that this finding could be, in part, a function of the tendency among avoidantly attached individuals to experience limited awareness of physiological responses.

Hypothesis 1.3. The relationships between reported diagnosis of asthma and virtually all variables (symptoms of dysfunctional breathing, difficulty regulating emotion [total score and six scales], romantic attachment anxiety and romantic attachment avoidance) were nonsignificant. The only statistically significant bivariate relationship with diagnosis of asthma was a small positive correlation with symptoms of hyperventilation ($r = .16$, $p < .05$). At first glance, these results seem surprising due to the existing empirical support for relationships between diagnosis of asthma and characteristics of dysfunctional breathing (Meek, Lareau, & Hu, 2003), hyperventilation (Meuret & Ritz, 2010), emotion regulation (Ritz, 2004), and attachment insecurity (Cassibba, van IJzendoorn, Bruno, & Coppola, 2004). It is important to note, however, that whereas 177 participants (87.2%) reported no diagnosis of a breathing problem, only 24 (11.8%) reported diagnosis of asthma. Since the inequality of category size between individuals who reported a diagnosis of asthma and those who did not is a real reflection of such populations, a statistical correction would be inappropriate (Becker, 1986) and was not conducted. As such, though it is possible that these nonsignificant results reflect a true contradiction to the current literature, the low number of participants who reported diagnosis of asthma may have resulted in inadequate statistical power for these point-biserial correlations. In the latter case, the small and nonsignificant findings are not entirely surprising. Further research with a larger sample of individuals who report a diagnosis of asthma is needed to investigate these relationships.

Hypothesis 1.4. There were moderate significant positive relationships between romantic attachment anxiety and difficulty regulating emotion (total score as well as all of the dimensions of Clarity, Nonacceptance, Goals, Impulsivity, Awareness, and Strategies). Additionally, there were also significant small and moderate positive relationships between romantic attachment avoidance and the difficulty with emotion regulation total score as well as five of the DERS scales of Clarity, Nonacceptance, Impulsivity, Awareness, and Strategies. The relationship between attachment avoidance and the Goals scale was non-significant. Overall, these findings support hypothesis 1.4 that greater romantic attachment anxiety and attachment avoidance would be related to greater difficulty regulating emotion. The strongest relationships between attachment anxiety and emotion regulation difficulty were with the total score ($r = .60$, $p < .01$) and Strategies subscale ($r = .60$, $p < .01$) whereas the strongest relationships between attachment avoidance and emotion regulation difficulty were with the subscales of Clarity ($r = .43$, $p < .01$) and Awareness ($r = .41$, $p < .01$).

These findings are consistent with empirically established relationship between attachment insecurity and difficulty regulating emotion as well as differences in approaches to emotion regulation between insecure styles of anxious and avoidant attachment (e.g., Cloitre, Stovall-McClough, Zorbas, & Charuvastra, 2008; Skowron & Friedlander, 1998; Wei, Vogel, Ku, & Zakalik, 2005). For instance, the deactivating emotion regulation strategies associated with avoidant attachment style include lack of awareness of negative emotions, distancing, and denial of emotions such as fear (Mikulincer et al., 2003), these qualities are consistent with items in the Clarity scale

such as "I have no idea how I am feeling" as well as items in the Awareness scale such as the reverse scored item "I pay attention to how I feel." The hyperactive approaches to emotion regulation that have been associated with anxious attachment in the existing literature include diminished self-view and catastrophized beliefs (Mikulincer et al., 2003), which are consistent with items in the Strategies scale such as "when I'm upset, I believe that I will remain that way for a long time" and "when I'm upset, I start to feel very bad about myself."

Research Question 2

Hypothesis 2.1 and 2.2. The results supported both hypothesis 2.1 (participants who report clinically significant hyperventilation symptoms report higher scores on romantic attachment [anxiety and avoidance dimensions] and greater difficulty regulating emotion than participants who report mild or clinically normal hyperventilation symptoms) and 2.2 (participants who report clinically normal hyperventilation symptoms report lower scores on romantic attachment [anxiety and avoidance dimensions] and difficulty regulating emotion than participants who report mild or clinically significant hyperventilation symptoms.)

There were significant differences in scores of romantic attachment anxiety among the means of the three groups of individuals who reported symptoms of hyperventilation that were either clinically mild, normal, or significant ($F_{2,200}$ =14.23, $p < .001$). Participants who reported clinically normal symptoms of hyperventilation reported the lowest scores on attachment anxiety and the participants who reported clinically significant symptoms of hyperventilation reported the highest scores on

attachment anxiety. Similarly, there were significant differences in scores of romantic attachment avoidance among the means of the three groups of hyperventilation symptoms that were either clinically mild, normal, or significant ($F_{2,200} = 10.43$, $p < .001$). Participants who reported clinically normal symptoms of hyperventilation also reported the lowest scores on attachment avoidance and the participants who reported clinically significant symptoms of hyperventilation reported the highest scores on attachment avoidance. Additionally, there were significant differences in mean scores on difficulty regulating emotion among the means of the three groups ($F_{2,200} = 21.51$, $p < .001$). The participants who reported clinically normal symptoms of hyperventilation reported the lowest scores on difficulty regulating emotion while the participants who reported clinically significant symptoms of hyperventilation reported the highest scores on difficulty regulating emotion. Though the means were higher on all three variables among individuals who reported mild symptoms than those who reported normal symptoms, the mean differences in difficulty regulating emotion, romantic attachment avoidance, and romantic attachment anxiety, between normal and mild groups were nonsignificant. The mean scores of all three dependent variables were significantly higher among those who reported clinically significant symptoms than those in both the normal and mild symptom groups.

Though the relationships between hyperventilation, attachment anxiety and attachment avoidance are new contributions to the literature, these results confirm relevant literature linking attachment insecurity to difficulty in both emotional (e.g., Goodall, Trejnowska, & Darling, 2012; Mikulincer et al., 2003) and physiological

regulation (e.g., Hicks & Diamond, 2011; Maunder, Lancee, Nolan, Hunter, & Tannenbaum, 2006). Additionally, since individuals who reported clinically significant symptoms of hyperventilation also reported scores of attachment anxiety, attachment avoidance, and difficulty regulating emotion that were significantly higher than individuals who reported either normal or mild symptoms, it is possible that assessing for clinical symptoms of hyperventilation may be an important component of holistic mental health assessment for the purpose of informing treatment aimed at improving emotion regulation and/or increasing attachment security. To date, however, research examining these relationships has been primarily cross-sectional and correlational. Accordingly, directional causality is, as yet, unknown. It remains to be empirically examined if there is a causal direction and in which direction this causal relationship occurs. Further, inasmuch as causation cannot be inferred from these findings, it remains unknown how interventions that impact hyperventilation symptoms might influence a more secure attachment strategy.

Research Question 3

Hypothesis 3.1 and 3.2. The results supported hypothesis 3.1 that symptoms of hyperventilation and dysfunctional breathing would account for a significant portion of the variance in romantic attachment anxiety among a young adult sample. The regression testing attachment anxiety on symptoms of dysfunctional breathing and hyperventilation was significant (adjusted R^2 = .13, $F_{2,200} = 16.28$, $p < .001$). Only hyperventilation symptoms was a significant predictor of difficulty regulating emotion in the model ($t = 2.86$, $p = .005$). , indicating that dysfunctional breathing did not offer unique

contribution in this model. The results also supported hypothesis 3.2 that symptoms of hyperventilation and dysfunctional breathing would account for a significant portion of the variance in romantic attachment avoidance. The regression testing attachment avoidance on symptoms of dysfunctional breathing and hyperventilation was statistically significant (adjusted R^2 = .07, $F_{2,200} = 8.60$, $p < .001$), although this is a modest effect size. Like the first regression, hyperventilation was the only significant predictor of attachment avoidance in the model ($t = 2.89$, $p = .004$).

These results indicated that the dimensions of dysfunctional breathing account for a small but significant portion of the variance in both attachment anxiety (13%) and attachment avoidance (7%). It is unknown whether the relationship between dysfunctional breathing and attachment avoidance is an accurate representation because, as previously mentioned, previous researchers (Diamond et al., 2006) found that individuals who report greater attachment avoidance tend to have lower awareness and subsequent reporting of physiological experiences. Though no causal conclusions can be drawn, this new support for relationships between dimensions of dysfunctional breathing and dimensions of attachment insecurity offers preliminary support for the possibility that breathing could play an important role in attachment processes, including conscious and non-conscious bodily-based communication.

Research Question 4

Hypothesis 4. The results of the analysis offered support for the hypothesis that symptoms of hyperventilation, dysfunctional breathing, and romantic attachment dimensions account for a significant portion of the variance in total emotion regulation

difficulty. The regression testing difficulty regulating emotion on attachment anxiety, attachment avoidance, symptoms of dysfunctional breathing and hyperventilation was significant (adjusted R^2 = .45, $F_{4,198} = 42.55$, $p < .001$). It is noteworthy, in particular, that this prediction equation resulted in a large effect size. Romantic attachment anxiety ($\beta = .47$, $t = 7.35$, $p < .001$) and symptoms of dysfunctional breathing ($\beta = .27$, $t = 3.56$, $p < .001$) were the only significant predictors of difficulty regulating emotions, accounting for 45% of the variance in difficulty regulating emotion. The dimensions of both dysfunctional breathing and attachment insecurity appear to be strongly related to emotion regulation difficulty with romantic anxiety being stronger than dysfunctional breathing. Previous researchers have reported also that attachment insecurity is related to maladaptive self-regulation evidenced by variables such as poor vagal tone and emotion responses (e.g., Schneiderman, Zilberstein-Kra, Leckman, & Feldman, 2011). The results of this study support these previous findings while also pointing more specifically at the physiological system of respiration as one that may be both influenced and influential. In other words, these results indicate that attachment insecurity is related to maladaptive self-regulation evidenced by symptoms of dimensions of dysfunctional breathing as well as difficulty regulating emotion. Further, in light of the known relationship between breath characteristics and RSA (Courtney et al., 2011a), as well as RSA and vagal regulation (Porges, 2007), these findings may indicate that patterns of breathing associated with symptoms of hyperventilation and dysfunctional breathing could indeed play a role in the sympathetic reactivity and maintenance of sympathetic activation (vagal regulation) known to be associated with insecure attachment styles and

difficulty regulating emotion. As such, these results offer further support for the existing links between attachment and physiological regulation, possibly including vagal regulation (Schneiderman, Zilberstein-Kra, Leckman, & Feldman, 2011). These findings also lend further, though preliminary, support for the assertion that controlling for breathing characteristics in investigations of attachment and ANS functioning is likely erroneous and could be controlling for the very physiological system that is essential to attachment processes.

Research Question 5

Hypothesis 5.1. and 5.2. The results did not support hypothesis 5.1 that romantic attachment anxiety moderates the relationships between difficulty regulating emotion and symptoms of both hyperventilation and dysfunctional breathing among a young adult sample, nor was there support for hypothesis 5.2 that romantic attachment avoidance moderates the relationships between difficulty regulating emotion and the symptoms of hyperventilation and dysfunctional breathing among a young adult sample. Hierarchical multiple regression was used to test moderation. The four interaction terms, attachment anxiety and hyperventilation, attachment anxiety and dysfunctional breathing, attachment avoidance and hyperventilation, and attachment avoidance and dysfunctional breathing, were nonsignificant predictors of emotion regulation difficulty. Issues of multicollinearity were addressed and did not appear to be responsible for nonsignificant findings. Nonetheless, the issues of multicollinearity in this analysis illustrate the need for one single, reliable and valid measure of all known dimensions of dysfunctional breathing.

There are several considerations regarding these nonsignificant results. A moderation effect addresses "when" or "for whom" a predictor variable most strongly causes a criterion variable (Wu & Zumbo, 2007, p. 371). Researchers have described that moderators are most commonly relatively stable characteristics and though the moderation model is considered a causal model, testing for moderation is appropriate both when causal relationships have and have not been established. Though there is conceptual support that the relationship between symptoms of dysfunctional breathing and difficulty regulating emotion could vary by romantic attachment dimensions, moderating effects are most commonly found when the variable is uncorrelated with the independent variable (Wu & Zumbo, 2007). In this case there were statistically significant correlations among the predictor and hypothesized moderating variables. Additionally, moderators most typically have a single role as an auxiliary predictor variable (Wu & Zumbo, 2007). In this case, however, attachment anxiety and attachment avoidance could be both criterion variable for the dimensions of breathing dysfunction (as in research question 3) and the predictor variable for difficulty regulating emotion (as in research question 4) which may be more indicative of a possible mediating effect. Now that these relationships have been supported, it is possible that rather than addressing the question of "for whom" through testing a moderating effect, it may be more appropriate to address the issue of "how" through the investigation of a mediating effect. Some researchers have recommended that mediating effects should only be investigated if a causal relationship has been established in the literature (Wu & Zumbo, 2007). In light of the significant relationships found among these variables, future

investigation into potential causal relationships and possible mediating effects may be warranted.

Limitations

Though the results of this study contribute to the understanding of the relationships among attachment, emotion regulation and breathing, it is important that the findings are interpreted within the context of the study limitations. The first limitation is that no causal conclusions can be drawn due to the cross-sectional design used in this study. Another limitation is that all of the data were self-reported and could not be verified to ensure accuracy. In particular, this may be problematic for participants with high scores on attachment avoidance as such individuals appear to have a tendency toward limited awareness and reduced reporting of physiological experiences. Additionally, convenience sampling was used through researchmatch.org, which resulted in a fairly homogeneous sample in several respects. For example, only 10.3% of the participants were male and the majority of the sample were white, female, college educated, heterosexuals who were not parents and were in a current long-term romantic relationship. Generalizability is further limited because it is unknown how participants differed from those who received the invitation and elected not to participate. Additionally, it is unknown how individuals who were registered as potential volunteers through researchmatch.org may differ from individuals who have not registered as potential volunteers with researchmatch.org. Though this sample may be representative of the ResearchMatch.org population, the generalizability of this study's results to other populations is limited.

Another area of limitation is the measurement of the dimensions of breath dysfunction. In addition to previously identified limitations of self-report, some participants could have limited awareness of their physiological experiences (i.e., individuals with avoidant attachment style; Diamond, Hicks, & Otter-Henderson, 2006), which may have resulted in under or imprecise reporting of breathing symptoms. Additionally, though the NQ and SEBQ-2 were designed to measure different dimensions of dysfunctional breathing, using multiple measures to assess the dimensions of dysfunctional breathing did lead to issues of multicollinearity. As described in the data analysis section of chapter 4, multicollinearity issues arose in the analysis of research question 5.

Additionally, it is possible that the instructions of the ECR-R may have confused participants who have had only one romantic relationship as evidenced by emails received from two participants. Two participants emailed the researcher to inquire if they should complete the survey because they thought that the ECR-R instructions ("we are interested in how you *generally* experience romantic relationships, not just in what is happening in a current relationship") implied that one should have had more than one romantic relationship in order to complete the survey. Both participants reported being currently in a long-term romantic relationship with the only partner they have had in their adult life. Thus, it is unknown how this instruction was interpreted by other participants and it may have led to non-participation from some individuals who have not had multiple adult romantic relationships.

Implications for Practice

In the current study, both conceptual and empirical support emerged for the relationships among attachment, breathing, and emotion regulation among a sample of young adults. The constructs of breathing, attachment, and emotion-regulation and the relationships among them could be a promising area for counselors, counselor educators, and researchers.

There are a host of implications for counselors to consider related to breath, attachment, and emotion regulation in the assessment, conceptualization, and treatment of mental health issues among young adults. There are strong relationships among attachment, self-regulation, and breathing, and both attachment (Sroufe, 2005) and self-regulation are linked with mental health outcomes (e.g., Aherne, Moran, & Lonsdale, 2011; Stifter, Dollar, & Cipriano, 2011; Watson, McMullen, Prosser, & Bedard, 2011). It is in this context that breath-based approaches may be a promising direction for mental health counselors. Although causal relationships between breathing and mental health outcomes remain an empirical question, there appears to be a need for counselors who are able to competently address issues related to breathing and incorporate breath-based approaches in assessment and treatment planning. There is preliminary support that the application of breath-based approaches may not only promote adaptive emotion regulation and healthy ANS functioning, but that the application of breathing interventions could potentially be related to the promotion of attachment security and healthy relational functioning, though these causal relationships have yet to be determined empirically.

The first step toward integrating breath-based approaches in counseling is that of assessment. Discerning between healthy and dysfunctional breathing patterns could help to inform counselors understanding of client's self-regulation patterns as well as potential impact on attachment communication. It may be beneficial for counselors to learn to assess breath pattern characteristics including symptoms of dysfunctional breathing associated with breath rate, volume, movement, depth, pause location, and duration. In fact, since the counselor can be conceptualized as an attachment figure (Shaver & Mikulincer, 2010), and as a "psychobiological regulator" (Gill, 2009, p. 260) for the client, it may be a promising direction for counselors to assess patterns of breathing in the moment and learn to use their own breath as an intentional tool to influence psychobiological counselor-client attunement and emotion regulation in-session.

In particular, counselors who used attachment and emotion based approaches to assessment and treatment could find is useful to integrate breath-based approaches into their practice. For instance, one of the goals of counselors conducting Emotion Focused Therapy (EFT) with couples is to facilitate the "creation and maintenance of safe haven and secure based with both partners in therapy sessions" in order to establish the conditions necessary for clients to effectively explore and express emotions (Johnson, 2011, p. 39) and later generalize these skills in daily living. In this way, counselors using EFT help clients to develop greater attachment security and the effective self and co-regulation of emotion. One of the tools that counselors utilize toward this end is the intentional application of their vocalization such as tone, pacing, and volume (Johnson, 2011). Despite the known relationships between breath and both vocalization (Ley,

1999) and emotion (Koole, 2009), breath-based approaches have not been systematically integrated in EFT training to-date. This omission is likely because EFT is an attachment-based approach and, prior to the current study, the explicit relationships between breath and attachment had not been investigated. Though causal relationships have yet to be determined, it is possible that in the EFT context, counselors could learn to intentionally use their own breath not only to influence their vocalization but also the present-moment attachment-related processes of psychobiological attunement and emotion regulation.

Additionally, though the findings of this study do not imply causal relationships, both attachment anxiety and attachment avoidance were strongly related to symptoms of hyperventilation. Accordingly, it is possible that counselors may find interventions aimed at promoting slow diaphragmatic breathing are a useful avenue for promoting adaptive self-regulation among individuals who experience insecure attachment. There are also specific implications for working with individuals who experience greater attachment avoidance. For instance, in the current study attachment avoidance was associated with issues of dysfunctional breathing and difficulty regulating emotion. Further, other researchers have established that individuals who experience attachment avoidance also tend to lack awareness of both physiological and emotional responses (Diamond, Hicks, & Otter-Henderson, 2006). Thus, when incorporating breath-based approaches in the conceptualization and treatment planning of individuals who experience attachment avoidance, it may be beneficial to initially focus on promoting awareness of breathing and the related physiological sensations prior to moving toward altering the breath to establish healthy patterns of breathing. Additionally, it may be particularly beneficial to

utilize biofeedback tools with avoidantly attached clients in order to help them to understand and recognize what is happening in their bodies.

The implications for counselor educators parallel many of those for counselors. There is a need for counselor educators who can competently offer counselor training that is focused on mind-body spirit relationships, psychobiology of attachment, and breath-based approaches to assessment and treatment. First, counselor educators must investigate how to best train counselors on the application of holistic breath-based approaches. The following questions warrant consideration: What do counselors need to know in order to ethically and effectively utilize breath-based approaches? How can counselors conduct effective assessment in order to tailor treatment to address attachment, breath, and emotion regulation needs? What aspects of physiology must counselors understand to competently address issues related to psychobiology of attachment? What do counselors need to know in order to appropriately identify the need for medical referral? What do counselors need to know about the cultural considerations related to breathing, attachment, and emotion regulation? What constitutes competency in this area? These questions and others are ripe for additional research.

Recommendations for Future Research

There remain many unknowns in this area of study and the results of this study support the assertion that the psychobiology of attachment and, specifically, the relationships among attachment, breathing, and emotion regulation is a promising direction for continued research. In addition to the previously identified areas for research in counselor education, potential future directions include investigating these

constructs among diverse populations, developing and testing both observational and survey-based approaches to assessment, and both developing and testing interventions for prevention and treatment of mental health problems.

First, given the limitations of the sample for the current study, it would be highly useful to investigate the relationships among these constructs across diverse populations including age, ethnicity, gender, and sexual identity. In particular, it may be useful to investigate age, gender, and socio-economic (SES) differences. Though there is debate in the literature, some researchers have reported that individuals who are either young, male, or experience low SES tend to report greater attachment avoidance (van IJzendoorn & Bakermans-Kranenburg, 2010) while greater attachment anxiety may be more common among females (Del Giudice, 2009). Investigating what, if any, differences exist among these groups among the constructs of attachment, breathing, and emotion regulation could be useful in informing best practices in individual, couple, and family counseling. Further, though attachment theory is relevant to both heterosexual and same-sex attracted adults, research on attachment and attachment-related constructs among non-heterosexuals has been sparse (Keleher, Wei, & Liao, 2010). Thus, it may also be useful to address this gap through the investigation of these constructs among non-heterosexual populations. Also, though attachment, breathing, and emotion-regulation are constructs that are relevant across cultures and ethnicities, because values and cultural norms related to attachment, emotion, and breathing do vary across groups, it would be very useful to investigate these constructs across a variety of cultural groups and ethnicities.

Another avenue for future investigations is the development and testing of a single self-report measure of all dimensions of dysfunctional breathing. The development of a single valid and reliable measure of the dimensions of dysfunctional breathing would improve the validity of future research by reducing problems of measurement and analysis related to using more than one instrument for one construct. Additionally, since individuals who experience greater attachment avoidance also may experience difficulty accurately reporting their physiological experiences, it may be useful to develop reliable and valid approaches to observational assessment as well as to incorporate physiological measures of breathing in future studies. Finally, there is a need to develop and test the short and long-term efficacy of holistic interventions designed to promote adaptive breathing, secure attachment, and adaptive emotion-regulation.

Conclusion

The increasing prevalence of psychological problems among young adults is thought to create and reinforce generational patterns of insecure attachment, maladaptive self-regulation, and, as such, continued mental health issues within families (Stallard et al., 2004). Researchers have asserted that links between attachment and mental health may be largely attributed to self-regulation of both emotional and physiological systems (Feeney, 2000; Sbarra & Hazan, 2008) and that the investigations into the psychobiology of attachment are necessary to inform the advancement of holistic mental health strategies (Diamond & Fagundes, 2010). Breathing is a physiological process that is critical to self-regulation (Courtney, Cohen, & van Dixhoorn, 2011a; Koole, 2009) yet previous researchers have not explicitly addressed the relationships among breathing,

attachment and emotion-regulation. This study is the first to explore the relationships among these constructs. The results of this study indicated that there are significant relationships among romantic attachment anxiety, attachment avoidance, difficulty regulating emotion, symptoms of hyperventilation, and symptoms of dysfunctional breathing in a convenience sample of young adults. In fact, the model testing attachment avoidance, attachment anxiety, dysfunctional breathing, and hyperventilation on difficulty regulating emotion accounted for 45% of the variance in emotion regulation difficulty. These findings lend preliminary support for the argument that controlling for respiration in investigations of attachment and ANS functioning could be erroneous and, in fact, may be controlling for a physiological system that is involved in attachment processes. Further, though causal relationships have not yet been determined empirically, there is preliminary support that the application of breath-based approaches may not only promote adaptive emotion regulation and healthy ANS functioning but could also potentially promote attachment security and healthy relational functioning. Based on the results of this study, it is hypothesized that the integration of attachment-based and breath-based interventions could yield greater improvement in self-regulation, and thus treatment outcomes, among young adults, than either approach in isolation. Still, there remain many gaps in the knowledge of the psychobiology of attachment and the relationships among attachment, breathing, and emotion regulation. Continued research in this area could serve to inform best practices and holistic approaches to prevention, assessment, and treatment of mental health issues. Potential future directions include investigating these constructs among a host of diverse populations, developing and

testing assessment tools, and both developing and testing the short and long term efficacy of interventions for prevention and treatment of mental health problems. Such work is important to continue to improve short and long term outcomes by addressing client issues in a competent, integrated, and holistic manner.

REFERENCES

Agostini, A., Rizzello, F., Ravegnani, G., Gionchetti, P., Tambasco, R., Straforini, G., … Campieri, M. (2010). Adult attachment and early parental experiences in patients with Crohn's disease. *Psychosomatics*, *51*, 208–215.

Aherne, C., Moran, A. P., & Lonsdale, C. (2011). The effect of mindfulness training on athletes' flow: An initial investigation. *The Sport Psychologist*, *25*, 177–189.

Ainsworth, M. D. S. (1964). Patterns of attachment behavior shown by the infant in interaction with his mother. *Merrill-Palmer Quarterly of Behavior and Development*, *10*, 51–58.

Ainsworth, M. D. S. (1967). *Infancy in Uganda: Infant care and the growth of love*. Baltimore: Johns Hopkins.

Ainsworth, M. D. S. (1969). Object relations, dependency, and attachment: A theoretical review of the infant-mother relationship. *Child Development*, *40*, 969–1025.

Ainsworth, M. D. S. (1989). Attachments beyond infancy. *The American Psychologist*, *44*, 709–716.

Ainsworth, M. D. S., & Bell, S. M. (1970). Attachment, exploration, and separation: Illustrated by the behavior of one-year-olds in a strange situation. *Child Development*, *41*, 49–67.

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation*. Hillsdale, N.J: Lawrence Erlbaum.

Ainsworth, M. D. S., & Bowlby, J. (1991). An ethological approach to personality development. *American Psychologist*, *46*, 333–341.

Ainsworth, M. D. S., King, P., & Rayner, E. (1992). John Bowlby (1907-1990). *American Psychologist*, *47*, 668

Ainsworth, M. D. S., & Marvin, R. S. (1995). On the shaping of attachment theory and research: An interview with Mary D.S. Ainsworth. *Monographs of the Society for Research in Child Development*, *60*, 2–21..

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*, 217–237.

Allen, B., & Friedman, B. H. (2012). Positive emotion reduces dyspnea during slow paced breathing. *Psychophysiology*, *49*, 690–696.

Allen, J. J. B., Chambers, A. S., & Towers, D. N. (2007). The many metrics of cardiac chronotropy: A pragmatic primer and a brief comparison of metrics. *Biological Psychology*, *74*, 243–262.

Allen, T. E., & Agus, B. (1968). Hyperventilation leading to hallucinations. *The American Journal of Psychiatry, 125*, 632–637.

Altose, M. D., & Cherniack, N. S. (2005). The behavioral control of breathing: Sensory and motor aspects. *Current Respiratory Medicine Reviews*, *1*, 219–226.

Araneda, M. E., Santelices, M. P., & Farkas, C. (2010). Building infant–mother attachment: The relationship between attachment style, socio-emotional well-being and maternal representations. *Journal of Reproductive and Infant Psychology*, *28*, 30–43.

Aravinda Prabhu, H. R., Bhat, P. S. S., & Prabhu, H. R. A. (2013). Mind and consciousness in yoga - Vedanta: A comparative analysis with western psychological concepts. *Indian Journal of Psychiatry*, *55*, 182–186.

Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (2009). The first 10,000 Adult Attachment Interviews: Distributions of adult attachment representations in clinical and non-clinical groups. *Attachment & Human Development*, *11*, 223–263.

Baron, L. J., & Faubert, C. (2005). The role of Tai Chi Chuan in reducing state anxiety and enhancing mood of children with special needs. *Journal of Bodywork and Movement Therapies*, *9*, 120–133.

Bartholomew, K., & Horowitz, L. M. (1991). Attachment styles among young adults: A test of a four-category model. *Journal of Personality and Social Psychology*, *61*, 226–244.

Becker, G. (1986). Correcting the point-biserial correlation for attentuation owing to unequal sample size. *The Journal of Experimental Education*, *55*, 5–8.

Beevers, C. G., Ellis, A. J., & Reid, R. M. (2010). Heart rate variability predicts cognitive reactivity to a sad mood provocation. *Cognitive Therapy and Research*, *35*, 395–403.

Benchetrit, G., Shea, S. A., Dinh, T. P., Bodocco, S., Baconnier, P., & Guz, A. (1989). Individuality of breathing patterns in adults assessed over time. *Respiration Physiology*, *75*, 199–209.

Berecz, J. M. (2008). Social self in cultural context. In *Theories of personality: A zonal perspective*. Boston: Pearson.

Berghaus, B. J. (2011). A new look at attachment theory & adult "attachment" behavior. *Behaviorolgy Today*, *14*, 3–10.

Berlin, L. J., Zeanah, C. H., & Lieberman, A. F. (2008). Prevention and intervention programs for supporting early attachment security. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of Attachment Theory, Research, and Clinical Applications* (Second., pp. 745–761). New York: Guilford.

Blazer, D. G., & Hybels, C. F. (2010). Shortness of breath as a predictor of depressive symptoms in a community sample of older adults. *International Journal of Geriatric Psychiatry*, *25*, 1080–1084.

Blechert, J., Wilhelm, F. H., Meuret, A. E., Wilhelm, E. M., & Roth, W. T. (2013). Experiential, autonomic, and respiratory correlates of CO2 reactivity in individuals with high and low anxiety sensitivity. *Psychiatry Research*, 566–573.

Bloch, S., Lemeignan, M., & Aguilera, N. (1991). Specific respiratory patterns distinguish among human basic emotions. *International Journal of Psychophysiology*, *11*, 141–154.

Boiten, F. a, Frijda, N. H., & Wientjes, C. J. (1994). Emotions and respiratory patterns: Review and critical analysis. *International Journal of Psychophysiology*, *17*, 103–128.

Booher, B. (2013). The cure for the common medical practice. *Duke Magazine*, 36–41.

Boule, M., Gaultier, C., & Girard, F. (1989). Breathing pattern during exercise in untrained children. *Respiration Physiology*, *75*, 225–233.

Bowlby, J. (1953). Separation anxiety: A critical review of the literature. *Journal of Child Psychology and Psychiatry*, *1*, 251–269.

Bowlby, J. (1957). An ethological approach to research in child development. *British Journal of Medical Psychology*, *30*, 230–240.

Bowlby, J. (1958). The nature of the child's tie to his mother. *International Journal of Psychoanalysis*, *39*, 350–373.

Bowlby, J. (1973). *Attachment and loss volume II: Separation*. New York: Basic Books.

Bowlby, J. (1980). *Attachment and loss volume III: Loss*. New York: Basic Books.

Bowlby, J. (1981). Psychoanalysis as a natural science. *Higher Education Quarterly*, *35*, 483–503.

Bowlby, J. (1982). *Attachment Volume I* (Second Edi.). New York: Basic Books.

Bowlby, J., & Ainsworth, M. D. S. (1965). *Childcare and the growth of love*. (M. Fry, Ed.). Baltimore: Penguin Books Inc.

Bradshaw, G. a., & Schore, A. N. (2007). How elephants are opening doors: Developmental neurothology, attachment and social context. *Ethology*, *113*, 426–436.

Brandell, J. R. (2010). Contemporary psychoanalytic perspectives on attachment. *Psychoanalytic Social Work*, *17*, 132–157.

Brandt, C. P., Johnson, K. A., Schmidt, N. B., & Zvolensky, M. J. (2012). Main and interactive effects of emotion dysregulation and breath-holding duration in relation to panic-relevant fear and expectancies about anxiety-related sensations among adult daily smokers. *Journal of Anxiety Disorders*, *26*, 173–181.

Brenes, G. A. (2003). Anxiey and chronic obstructive pulmonary disease: Prevalence, impact, and treatment. *Psychosomatic Medicine*, *65*, 963–970.

Brennan, K. A., Clark, C. L., & Shaver, P. R. (1998). Self-report measurement of adult romantic attachment: An integrative overview. In J. A. Simpson & W. S. Rholes (Eds.), *Attachment theory and close relationships* (pp. 46–76). New York: Guilford Press.

Bretherton, I. (1992). The origins of attachment theory: John Bowlby and Mary Ainsworth. *Developmental Psychology*, *28*, 759–775.

Bretherton, I., & Main, M. (2000). Mary Dinsmore Saltworthy Ainsworth (1913-1999): Obituary. *American Psychologist*, *55*, 1148–1149.

Brown, C. L., Love, K. M., Tyler, K. M., Garriot, P. O., Thomas, D., & Roan-Belle, C. (2013). Parental attachment, family communalism, and racial identity among African American college students. *Journal of Multicultural Counseling and Development*, *41*, 108–122.

Brown, R. P., & Gerbarg, P. L. (2009). Yoga breathing, meditation, and longevity. *Annals of the New York Academy of Sciences, 1172*, 54–62.

Bureau, U. S. C. (2014). USA QuickFacts from the US Census Bureau. Retrieved February 10, 2014, from http://quickfacts.census.gov/qfd/states/00000.html

Burnette, J. L., Davis, D. E., Green, J. D., Worthington, E. L., & Bradfield, E. (2009). Insecure attachment and depressive symptoms: The mediating role of rumination, empathy, and forgiveness. *Personality and Individual Differences, 46*, 276–280.

Butler, E. A., Wilhelm, F. H., & Gross, J. J. (2006). Respiratory sinus arrhythmia, emotion, and emotion regulation during social interaction. *Psychophysiology, 43*, 612–622.

Butner, J., Diamond, L. M., & Hicks, A. M. (2007). Attachment style and two forms of affect coregulation between romantic partners. *Personal Relationships, 14*, 431–455.

Calkins, S. D. (2004). Early attachment processes and the development of emotional self-regulation. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, rheory, and applications* (pp. 324–339). New York: Guilford.

Campa, M. I., Hazan, C., & Wolfe, J. E. (2009). The form and function of attachment behavior in the dialy lives of young adults. *Social Development, 18*, 288–304.

Cassibba, R., van IJzendoorn, M., Bruno, S., & Coppola, G. (2004). Attachment of mothers and children with recurrent asthmatic bronchitis. *Journal of Asthma, 41*, 419–431.

Cassidy, J. (2008). The nature of the child's ties. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment theory, research, and clinical applications* (pp. 3–22). New York: Guilford.

Catanzaro, S. J., & Mearns, J. (1990). Measuring generalized expectancies for negative mood regulation: Initial scale development and implications. *Journal of Personality Assessment, 54*, 546–563.

Centers for Disease Control and Prevention. (2013). Burden of Mental Illness. *Mental Health*. Retrieved April 13, 2013, from http://www.cdc.gov/mentalhealth/basics/burden.htm

Chow, Y. W. Y., & Tsang, H. W. H. (2007). Biopsychosocial effects of qigong as a mindful exercise for people with anxiety disorders: A speculative review. *Journal of Alternative and Complementary Medicine, 13*, 831–839.

CliftonSmith, T., & Rowley, J. (2011). Breathing pattern disorders and physiotherapy: Inspiration for our profession. *Physical Therapy Reviews*, *16*, 75–86.

Cloitre, M., Stovall-McClough, C., Zorbas, P., & Charuvastra, A. (2008). Attachment organization, emotion regulation, and expectations of support in a clinical sample of women with childhood abuse histories. *Journal of Traumatic Stress*, *21*, 282–289.

Coan, J. a. (2010). Adult attachment and the brain. *Journal of Social and Personal Relationships*, *27*, 210–217.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, N.J: L. Erlbaum Associates.

Collins, N. L. (1996). Working models of attachment: Implications for explanation, emotion and behavior. *Journal of Personality and Social Psychology*, *71*, 810–832.

Cooley, E. L., & Garcia, A. L. (2012). Attachment style differences and depression in African American and European American college women: Normative adaptations? *Journal of Multicultural Counseling and Development*, *40*, 216–226.

Courtney, R. (2009). The functions of breathing and its dysfunctions and their relationship to breathing therapy. *International Journal of Osteopathic Medicine*, *12*, 78–85.

Courtney, R. (2011). *Dysfunctional breathing: Its parameters, measurement and relevance*. RMIT University.

Courtney, R., & Cohen, M. (2008). Investigating the claims of Konstantin Buteyko, M.D., Ph.D.: The relationship of breath holding time to end tidal CO2 and other proposed measures of dysfunctional breathing. *Journal of Alternative and Complementary Medicine*, *14*, 115–123.

Courtney, R., Cohen, M., & van Dixhoorn, J. (n.d.). Relationship between dysfunctional breathing patterns and ability to achieve target heart rate variability with features of "coherence" during biofeedback. *Alternative Therapies in Health and Medicine*, *17*, 38–44.

Courtney, R., & Greenwood, K. M. (2009). Preliminary investigation of a measure of dysfunctional breathing symptoms: The Self Evaluation of Breathing Questionnaire (SEBQ). *International Journal of Osteopathic Medicine*, *12*, 121–127.

Courtney, R., Greenwood, K. M., & Cohen, M. (2011). Relationships between measures of dysfunctional breathing in a population with concerns about their breathing. *Journal of Bodywork and Movement Therapies*, *15*, 24–34.

Courtney, R., van Dixhoorn, J., & Cohen, M. (2008). Evaluation of breathing pattern: comparison of a Manual Assessment of Respiratory Motion (MARM) and respiratory induction plethysmography. *Applied Psychophysiology and Biofeedback*, *33*, 91–100.

Courtney, R., van Dixhoorn, J., Greenwood, K. M., & Anthonissen, E. L. M. (2011). Medically unexplained dyspnea: Partly moderated by dysfunctional (thoracic dominant) breathing pattern. *The Journal of Asthma*, *48*, 259–265.

Crawford, A. (2010). If "the body keeps the score': Mapping the dissociated body in trauma narrative, intervention, and theory. *University of Toronto Quarterly*, *79*, 702–719.

Crockett, J. E., Cashwell, C. S., Bartley, J. L., Hall, K. H., & Young, J. S. (n.d.). The relationship between breathing characteristics and symptoms of psychological distress: An exploratory study.

Darling-Fisher, C. S., & Leidy, N. K. (1988). Measuring Eriksonian development in the adult: The modified Erikson psychological stage inventory. *Psychological Reports*, *62*, 747–754.

Darwin, C. (1872). *The expression of the emotions in man and animals*. London: Albemarle. Retrieved from http://babel.hathitrust.org/cgi/pt?id=inu.30000011861584;view=1up;seq=86

Davies, A., & Moores, C. (2003). *The respiratory system*. Edinburgh: Churchill Livingsone.

Del Giudice, M. (2009). Sex, attachment, and the development of reproductive strategies. *The Behavioral and Brain Sciences*, *32*, 1–21; discussion 21–67.

Demaree, H., Pu, J., Robinson, J., Schmeichel, B., & Everhart, E. (2006). Predicting facial valence to negative stimuli from resting RSA: Not a function of active emotion regulation. *Cognition & Emotion*, *20*, 161–176.

Demos, J. N. (2005). *Getting started with neurofeedback*. New York: W.W. Norton & Co.

Descilo, T., Vedamurtachar, A., Gerbarg, P. L., Nagaraja, D., Gangadhar, B. N., Damodaran, B., … Brown, R. P. (2010). Effects of a yoga breath intervention alone and in combination with an exposure therapy for post-traumatic stress disorder and depression in survivors of the 2004 South-East Asia tsunami. *Acta Psychiatrica Scandinavica*, *121*, 289–300.

Di Simplicio, M., Costoloni, G., Western, D., Hanson, B., Taggart, P., & Harmer, C. J. (2012). Decreased heart rate variability during emotion regulation in subjects at risk for psychopathology. *Psychological Medicine, 42*, 1775–1783.

Diamond, L. M. (2001). Contributions of psychophysiology to research on adult attachment: Review and recommendations. *Personality and Social Psychology Review, 5*, 276–295.

Diamond, L. M. (2005). Attachment style, current relationship security, and negative emotions: The mediating role of physiological regulation. *Journal of Social and Personal Relationships, 22*, 499–518.

Diamond, L. M., & Aspinwall, L. G. (2003). Emotion regulation across the life span: An integrative perspective emphasizing self-regulation, positive affect, and dyadic processes. *Motivation and Emotion, 27*, 125–156.

Diamond, L. M., & Cribbet, M. R. (2012). Links between adolescent sympathetic and parasympathetic nervous system functioning and interpersonal behavior over time. *International Journal of Psychophysiology*. doi:10.1016/j.ijpsycho.2012.08.008

Diamond, L. M., & Fagundes, C. P. (2010). Psychobiological research on attachment. *Journal of Social and Personal Relationships, 27*, 218–225.

Diamond, L. M., Fagundes, C. P., & Butterworth, M. R. (2012). Attachment style, vagal tone, and empathy during mother-adolescent interactions. *Journal of Research on Adolescence, 22*, 165–184.

Diamond, L. M., & Hicks, A. M. (2004). Psychobiological perspectives on Attachment: Implications for health over the lifespan. In S. W. Rholes & J. A. Simpson (Eds.), *Adult attachment: Theory, research, and clinical implications* (pp. 240–263). New York: Guilford.

Diamond, L. M., Hicks, A. M., & Otter-Henderson, K. (2006). Physiological evidence for repressive coping among avoidantly attached adults. *Journal of Social and Personal Relationships, 23*, 205–229.

Diamond, L. M., Hicks, A. M., & Otter-Henderson, K. D. (2008). Every time you go away: Changes in affect, behavior, and physiology associated with travel-related separations from romantic partners. *Journal of Personality and Social Psychology, 95*, 385–403.

Dickerson Peck, S. (2003). Measuring sensitivity moment-by-moment: Microanalytic look at the transmission of attachment. *Attachment & Human Development, 5*, 38–63.

Dignam, P., Parry, P., & Berk, M. (2010). Detached from attachment: Neurobiology and phenomenology have a human face. *Acta Neuropsychiatrica*, *22*, 202–207.

Edwards, J. R. (2008). Seven deadly myths of testing moderation in organizational research. In C. E. Lance & R. J. Vandenberg (Eds.), *Statistical and methodological myths and urban legends: Recieved doctrine, verity, and fable in the organizational and social sciences* (pp. 145–166). New York: Routledge.

Elliott, S., & Edmonson, D. (2006). *The New Science of Breath* (Second Edi.). Allen, Texas: Coherence.

Elliott, S., & Edmonson, D. (2008). *Coherent Breathing The Definitive Method - Theory & Practice*. Allen, Texas: Coherence.

Erikson, E. H. (1959). *Identity and the life cycles: Selected papers*. *Psychological Issues* (Vol. 1). New York: International Universities Press.

Erikson, E. H. (1963). *Childhood and society*. New York: Noton.

Erikson, E. H. (1968). *Identity, youth, and crisis.* New York: Norton.

Ethology. (2013). *Merriam-Webster Online*. Retrieved from http://www.merriam-webster.com/dictionary/ethology

Fahri, D. (1996). *The breathing book: Good health and vitality through essential breath work* (1st ed.). New York, NY: Henry Holt.

Fairchild, A. J., & Finney, S. J. (2006). Investigating validity evidence for the Experiences in Close Relationships - Revised Questionnaire. *Educational and Psychological Measurement*, *66*, 116–135.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149–1160.

Feeney, J. A. (2000). Implications of attachment style for patterns of health and illness. *Child: Care, Health and Development*, *26*, 277–88.

Feeney, J. A. (2008). Adult romantic attachment: Developments in the study of couple relationships. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of Attachment Theory, Research, and Clinical Applications* (Second., pp. 456–481). New York, NY: Guilford Press.

Feldman, R. (2003). Infant-mother and infant-father synchrony: The coregulation of positive arousal. *Infant Mental Health Journal*, *24*, 1–23.

Feldman, R. (2006). From biological rhythms to social rhythms: Physiological precursors of mother-infant synchrony. *Developmental Psychology*, *42*, 175–188.

Feldman, R. (2007). Parent-infant synchrony and the construction of shared timing; physiological precursors, developmental outcomes, and risk conditions. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *48*, 329–354.

Feldman, R., & Eidelman, A. I. (2007). Maternal postpartum behavior and the emergence of infant-mother and infant-father synchrony in preterm and full-term infants: The role of neonatal vagal tone. *Developmental Psychology*, *49*, 291–302.

Fitch, J. C., Pistole, M. C., & Gunn, J. E. (2010). The bonds of development: An attachment-caregiving model of supervision. *The Clinical Supervisor*, *29*, 20–34.

Flannelly, K. J., & Galek, K. (2010). Religion, evolution, and mental health: attachment theory and ETAS theory. *Journal of Religion and Health*, *49*, 337–350.

Fokkema, D. S. (1999). The psychobiology of strained breathing and its cardiovascular implications: a functional system review. *Psychophysiology*, *36*, 164–175.

Folgering, H., Haren, F. V., & Smits, M. (1990). The Nijmegen hyperventilation questionnaire in patients with pulmonary disease. *Biological Pscyhology*, *31*, 273–274.

Fonagy, P., Gergely, G., & Target, M. (2008). Psychoanalytic constructs and attachment theory and research. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment theory, research, and clinical applications* (pp. 783–810). New York: Guilford.

Fonagy, P., & Target, M. (1997). Attachment and reflective function: Their role in self-organization. *Development and Psychopathology*, *9*, 679–700.

Fox, N. A., & Hane, A. A. (2008). Studying the biology of human attachment. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment theory, research, and clinical applicationsttachment* (pp. 217–240). New York: Guilford.

Fraley, R. C. (2013). Instructions for the Experiences in Close Relationships-Revised (ECR-R) Questionnaire.

Fraley, R. C., Waller, N. G., & Brennan, K. a. (2000). An item response theory analysis of self-report measures of adult attachment. *Journal of Personality and Social Psychology*, *78*, 350–365.

Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of Counseling Psychology, 51*, 115–134.

Frentzel-Beyme, R., & Grossarth-Maticek, R. (2001). The interaction between risk factors and self-regulation in the development of chronic diseases. *International Journal of Hygiene and Environmental Health*, *204*, 81–88.

Funk, M., Drew, N., Freeman, M., & Faydi, E. (2010). *Mental health and development: Targeting people with mental health conditions as a vulnerable group*. Geneva, Switzerland: World Health Organization.

Garakani, A., Martinez, J. M., Aaronson, C. J., Voustianiouk, A., Kaufmann, H., & Gorman, J. M. (2009). Effect of medication and psychotherapy on heart rate variability in panic disorder. *Depression and Anxiety*, *26*, 251–258.

Gentzler, A. L., Rottenberg, J., Kovacs, M., George, C. J., & Morey, J. N. (2012). Atypical development of resting respiratory sinus arrhythmia in children at high risk for depression. *Developmental Psychobiology*, *54*, 556–567.

Gentzler, A. L., Santucci, A. K., Kovacs, M., & Fox, N. a. (2009). Respiratory sinus arrhythmia reactivity predicts emotion regulation and depressive symptoms in at-risk and control children. *Biological Psychology*, *82*, 156–163.

Gick, M. L. (2011). Singing, health and well-being: A health psychologist's review. *Psychomusicology: Music, Mind and Brain*, *21*, 176–207.

Gill, S. (2009). The Therapist as Psychobiological Regulator: Dissociation, Affect Attunement and Clinical Process. *Clinical Social Work Journal*, *38*, 260–268.

Gilroy, R. J., Manguar, B. T., & Lavietes, M. H. (1988). Rib cage and abdominal volume displacements during breathing in pregnancy. *The American Review of Respiratory Disease*, *137*, 668–672.

Gnilka, P. B., Ashby, J. S., & Noble, C. M. (2013). Adaptive and maladaptive perfectionism as mediators of adult attachment styles and depression, hopelessness, and life satisfaction. *Journal of Counseling & Development*, *91*, 78–86.

Goodall, K., Trejnowska, A., & Darling, S. (2012). The relationship between dispositional mindfulness, attachment security and emotion regulation. *Personality and Individual Differences*, *52*, 622–626.

Goodwin, L. K., Lee, S. M., Puig, A. I., & Sherrard, P. A. D. (2005). Guided imagery and relaxation for women with early stage breast cancer. *Journal of Creativity in Mental Health*, *1*, 53–67.

Goodwin, P., McGill, B., & Chandra, A. (2009). Who marries and when? Age at first marriage in the United States: 2002. *NCHS data brief*, 1–8.

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the Difficulties in Emotion Regulation Scale. *Journal of Psychopathology and Behavioral Assessment, 26*, 41–54.

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*, 271–299.

Grossman, P., & Taylor, E. W. (2007). Toward understanding respiratory sinus arrhythmia: Relations to cardiac vagal tone, evolution and biobehavioral functions. *Biological Psychology*, *74*, 263–285.

Grossman, P., & Wientjes, C. J. (2001). How breathing adjusts to mental and physical demands. *Respiration and Emotion*, 43–54.

Gustafson, K. M., May, L. E., Yeh, H., Million, S. K., & Allen, J. J. B. (2012). Fetal cardiac autonomic control during breathing and non-breathing epochs: The effect of maternal exercise. *Early Human Development, 88*, 539–546.

Gyurak, A., & Ayduk, O. (2008). Resting respiratory sinus arrhythmia buffers against rejection sensitivity via emotion control. *Emotion, 8*, 458–467.

Han, J., Zhu, Y., Li, S., Luo, D., Hu, Z., Van Diest, I., … van den Bergh, O. (2004). Medically unexplained dyspnea: Psychophysiological characteristics and role of breathing therapy. *Chinese Medical Journal, 234*, 1–8.

Harder, A. F. (2011). The developmental stages of Erik Erikson. *Learning Place Online*.

Harlow, H. F. (1953). Mice, monkeys, men, and motives. *Psychological review, 60*, 23–32.

Harlow, H. F. (1958). The nature of love. *American Psychologist, 13*, 673–685.

Harlow, H. F., & Zimmerman, R. R. (1958). The development of affectional rsponses in infant monkeys. *Proceedings of the American Philosophical Society, 102*, 501–509.

Harlow, H. F., & Zimmerman, R. R. (1959). Affectional responses in the infant monkey. *Science, 130*, 421–432.

Hart, S. (2011). *The impact of attachment: Developmental neuroaffective psychology*. New York: W.W. Norton & Co.

Hartmann, D., & Swartz, T. T. (2006). The new adulthood? The transition to adulthood from the perspective of transitioning young adults. *Advances in Life Course Research*, *11*, 253–286.

Hazan, C., & Shaver, P. (1987). Romantic love conceptualized as an attachment process. *Journal of Personality and Social Psychology*, *52*, 511–524.

Hertz, P., Addad, M., & Ronel, N. (2012). Attachment styles and changes among women members of overeaters anonymous who have recovered from binge-eating disorder. *Health and Social Work*, *37*, 110–123.

Hicks, A. M., & Diamond, L. M. (2011). Don't go to bed angry: Attachment, conflict, and affective and physiological reactivity. *Personal Relationships*, *18*, 266–284.

Hinde, R. A. (1964). Behavior of socially living monkeys in their first six months. *Proceedings of the Zoological Society of London*, *143*, 609–649.

Hofer, M. a. (2006). Psychobiological roots of early attachment. *Current Directions in Psychological Science*, *15*, 84–88.

Hopp, H., Troy, A. S., & Mauss, I. B. (2011). The unconscious pursuit of emotion regulation: Implications for psychological health. *Cognition & Emotion*, *25*, 532–545.

Huber, J. E., & Spruill, J. (2008). Age-related changes to speech breathing with increased vocal loudness. *Journal of Speech, Language, and Hearing Research*, *51*, 651–668.

Humphriss, R. L., Baguley, D. M., Andersson, G., & Wagstaff, S. (2004). Hyperventilation in the vestibular clinic: Use of the Nijmegen Questionnaire. *Clinical Otolaryngology and Allied Sciences*, *29*, 232–237.

Jaeger, R. M. (1990). *Statistics: A spectator sport* (Second Edi.). Newbury Park, CA: Sage.

Jakobsen, I. S., Horwood, L. J., & Fergusson, D. M. (2011). Childhood anxiety/withdrawal, adolescent parent-child attachment and later risk of depression and anxiety disorder. *Journal of Child and Family Studies*, *21*, 303–310.

Jimenez, S. S., Niles, B. L., & Park, C. L. (2010). A mindfulness model of affect regulation and depressive symptoms: Positive emotions, mood regulation expectancies, and self-acceptance as regulatory mechanisms. *Personality and Individual Differences*, *49*, 645–650.

Johnson, S. M. (2011). The attachment perspective on the bonds of love: A prototype for relationship change. In J. L. Furrow, S. M. Johnson, & B. A. Bradley (Eds.), *The emotionally focused casebook: New directions in treating couples* (pp. 31–58). New York, NY: Routledge.

Kagan, J. (2011). Bringing up baby: Are we too attached to attachment. *Psychotherapy Networker*, 28–51.

Kamholz, B. W., Hayes, A. M., Carver, C. S., Gulliver, S. B., & Perlman, C. A. (2006). Identification and evaluation of cognitive affect-regulation strategies: Development of a self-report measure. *Cognitive Therapy and Research, 30*, 227–262.

Karreman, A., & Vingerhoets, A. J. J. M. (2012). Attachment and well-being: The mediating role of emotion regulation and resilience. *Personality and Individual Differences, 53*, 821–826.

Keleher, J., Wei, M., & Liao, K. Y.-H. (2010). Attachment, Positive Feelings about Being a Lesbian, Perceived General Support, and Well-Being. *Journal of Social and Clinical Psychology*, *29*, 847–873.

Kemeny, M. E., Foltz, C., Cavanagh, J. F., Cullen, M., Giese-Davis, J., Jennings, P., … Ekman, P. (2012). Contemplative/emotion training reduces negative emotional behavior and promotes prosocial responses. *Emotion*, *12*, 338–350.

Kemp, M. A., & Neimeyer, G. J. (1999). Interpersonal attachment: Experiencing, expressing, and coping with stress. *Journal of Counseling Psychology*, *46*, 388–394.

Kessler, R. C., Petukhova, M., Sampson, N. A., & Zaslavsky, A. M. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research*, *21*, 169–184.

Koback, R., & Madsen, S. (2008). Disruptions in Attachment Bonds: Implications ofr theory, research, and clinical intervention. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment theory, research, and clinical applications* (pp. 23–47). New York: Guilford.

Koole, S. L. (2009). The psychology of emotion regulation: An integrative review. *Cognition & Emotion*, *23*, 4–41.

Kraemer, J. M., & Marquez, D. X. (2009). Psychosocial correlates and outcomes of yoga or walking among older adults. *The Journal of Psychology*, *143*, 390–404.

Kreibig, S. D., Wilhelm, F. H., Roth, W. T., & Gross, J. J. (2007). Cardiovascular, electrodermal, and respiratory response patterns to fear- and sadness-inducing films. *Psychophysiology*, *44*, 787–806.

Kum ar Yergani, V., Radhakrishna, R. K. ., Tancer, M., Uhde, T., & Yeragani, V. K. (2002). Nonlinear measures of respiration: Respiratory irregularity and increased chaos of respiration in patients with panic disorder. *Neuropsychobiology*, *46*, 111–120.

La Guardia, J. G., Ryan, R. M., Couchman, C. E., & Deci, E. L. (2000). Within-person variation in security of attachment: A self-determination theory perspective on attachment, need fulfillment, and well-being. *Journal of Personality and Social Psychology*, *79*, 367–384.

Lamagna, J. (2011). Of the self, by the self, and for the self: An intra-relational perspective on intra-psychic attunement and psychological change. *Journal of Psychotherapy Integration*, *21*, 280–307.

Lehrer, P. M., Vaschillo, E., & Vaschillo, B. (2000). Resonant frequency biofeedback training to increase cardiac variability: Rationale and manual for training. *Applied Psychophysiology and Biofeedback*, *25*, 177–191.

Levinson, D. J. (1978). *The seasons of a man's life*. New York: Knopf.

Lewis, D. (2006). *The Tao of natural breathing: For health, well-being, and inner growth*. Berkeley, California: Rodmell.

Ley, R. (1999). The modification of breathing behavior: Pavlovian and operant control in emotion and cognition. *Behavior Modification*, *23*, 441–479.

Liew, J., Eisenberg, N., Spinrad, T. L., Eggum, N. D., Haugen, R. G., Kupfer, A., … Baham, M. E. (2011). Physiological regulation and fearfulness as predictors of young children's empathy-related reactions. *Social Development*, *20*, 111–13.

Lloyd, C., Tsang, H., & Deane, F. (2009). Qigong as a mindful exercise intervention for people living with mental ill health. *International Journal of Therapy and Rehabilitation*, *16*, 393–400.

Long, R., & Macivor, C. (2006). *The key muscles of yoga: Your guide to functional anatomy in yoga*. S.I.: Bandha Yoga.

Lopez, F. G., & Gormley, B. (2002). Stability and change in adult attachment style over the first-year college transition: Relations to self-confidence, coping, and distress patterns. *Journal of Counseling Psychology*, *49*, 355–364.

Lorenz, K. Z. (1937). The companion in the bird's world. *The Auk*, *54*, 245–273.

Lynch, M. F. (2013). Attachment, autonomy, and emotional reliance: A multilevel model. *Journal of Counseling & Development*, *91*, 301–312.

Main, M. (1996). Introduction to the special section on attachment and psychopathology: 2. Overview of the field of attachment. *Journal of Consulting and Cinical Psychology*, *64*, 237243.

Mansky, P., Sannes, T., Wallerstedt, D., Ge, A., Ryan, M., Johnson, L. L., … Gerber, L. (2006). Tai chi chuan: Mind-body practice or exercise intervention? Studying the benefit for cancer survivors. *Integrative Cancer Therapies*, *5*, 192–201.

Martin, a. M., Paetzold, R. L., & Rholes, W. S. (2010). Adult attachment and exploration: Linking attachment style to motivation and perceptions of support in adult exploration. *Basic and Applied Social Psychology*, *32*, 196–205.

Maunder, R. G., & Hunter, J. J. (2001). Attachment and psychosomatic medicine: Developmental contributions to stress and disease. *Psychosomatic Medicine*, *63*, 5565–67.

Maunder, R. G., Lancee, W. J., Nolan, R. P., Hunter, J. J., & Tannenbaum, D. W. (2006). The relationship of attachment insecurity to subjective stress and autonomic function during standardized acute stress in healthy adults. *Journal of Psychosomatic Research*, *60*, 283–290.

Mauss, I. B., & Robinson, M. D. (2009). Measures of Emotion: A review. *Cognition & Emotion*, *23*, 209–237.

McCraty, R., & Childre, D. (2002). *The appreciative heart: The psychophysiology of positive emotions and optimal functioning*. Boulder Creek, CA: Institute of HeartMath, LLC.

McCraty, R., & Childre, D. (2010). Coherence: Bridging personal, social, and global health. *Alternative Therapies*, *16*, 10–24.

McWilliams, L. a, & Holmberg, D. (2010). Adult attachment and pain catastrophizing for self and significant other. *Pain*, *149*, 278–283.

Meek, P. M., Lareau, S. C., & Hu, J. (2003). Are self-reports of breathing effort and breathing distress stable and valid measures among persons with asthma, persons with COPD, and healthy persons? *Heart & Lung: The Journal of Acute and Critical Care*, *32*, 335–346.

Mennin, D. S., & Fresco, D. M. (2010). Emotion regulation as an integrative framework for understanding and treating psychopathology. In A. M. Kring & D. M. Sloan (Eds.), *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment* (pp. 356–379). New York, NY: Guilford.

Mercer, J. (2011). Attachment theory and its vicissitudes: Toward an updated theory. *Theory & Psychology*, *21*, 25–45.

Meuret, A. E., & Ritz, T. (2010). Hyperventilation in panic disorder and asthma: empirical evidence and clinical strategies. *International Journal of Psychophysiology*, *78*, 68–79.

Meuret, A. E., Ritz, T., Wilhelm, F. H., & Roth, W. T. (2005). Voluntary hyperventilation in the treatment of panic disorder--functions of hyperventilation, their implications for breathing training, and recommendations for standardization. *Clinical Psychology Review*, *25*, 285–306.

Meuret, A. E., Wilhelm, F. H., & Roth, W. T. (2004). Respiratory feedback for treating panic disorder. *Journal of Clinical Psychology*, *60*, 197–207.

Mikulincer, M., & Shaver, P. R. (2007). Boosting attachment security to promote mental health, prosocial values, and inter-group tolerance. *Psychological Inquiry*, *18*, 139–156.

Mikulincer, M., Shaver, P. R., & Pereg, D. (2003). Attachment theory and affect regulation: The dynamics, development, and cognitive consequences of attachment-related strategies. *Motivation and Emotion*, *27*, 77–102.

Miller, G., Chen, E., & Cole, S. W. (2009). Health psychology: Developing biologically plausible models linking the social world and physical health. *Annual Review of Psychology*, *60*, 501–524.

Mitchell, A. (2011). *Test-retest reliability and determinants of the Self Evaluation of Breathing Questionnaire (SEBQ): A measure of dysfunctional breathing*. Unitec Institute of Technology.

Mukerji, V. (1990). Dyspnea, orthopnea, and paroxysmal nocturnal dyspnea. In H. . Walker, W. D. Hall, & J. W. Hurst (Eds.), *Clinical Methods: The History, Physical, and Laboratory Examinations* (Third., pp. 78–80). Boston: Butterworths.

Myers, J. E., & Sweeney, T. J. (2005). The indivisible self: An evidence-based model of wellness. *The Journal of Individual Psychology*, *61*, 269–279.

National Institute of Mental Health. (n.d.). Suicide in the U.S.: Statistics and prevention.

National Institute of Mental Health. (2010). The National Institute of Mental Health strategic plan. Retrieved from http://nimh.nih.gov/about/strategic-planning-reports/index.shtml

National Institute of Mental Health, Branch, C. E., Chambers, D., & Chief, P. (2013). Outcomes and quality of care research program.

NIH. (2013). Mind Body Interactions. *National Institues of Health*. Retrieved May 02, 2013, from http://obssr.od.nih.gov/scientific_areas/biopsychosocial_interactions/mind_body/index.aspx

Orr, J. M., Sackett, P. R., & Dubois, C. L. Z. (1991). Outlier detection and treatment in I/O psychology: A survey of researcher beliefs and an empirical illustration. *Personnel Psychology*, *44*, 473–486.

Osborne, J. W., & Overbay, A. (2004). The power of outliers (and why researchers should always check for them). *Practical Assessment, Research & Evaluation, 9(6).* Retrieved February 01, 2014, from http://pareonline.net/getvn.asp?v=9&n=6

Padykula, N. L., & Conklin, P. (2009). The self-regulation model of adult trauma and addiction. *Clinical Social Work Journal*, *38*, 351–360.

Park, M. J., Paul Mulye, T., Adams, S. H., Brindis, C. D., & Irwin, C. E. (2006). The health status of young adults in the United States. *The Journal of Adolescent Health*, *39*, 305–317.

Pawlby, S., Sharp, D., Hay, D., & O'Keane, V. (2008). Postnatal depression and child outcome at 11 years: Rhe importance of accurate diagnosis. *Journal of Affective Disorders*, *107*, 241–245.

Peper, E., & Tibbetts, V. (1997). The use of electromyography , strain gauge , thermistor and incentive inspirometer biofeedback for training effortless breathing. *The Biofeedback Federation of Europe*.

Pepping, C. A., Davis, P. J., & O'Donovan, A. (2013). Individual differences in attachment and dispositional mindfulness: The mediating role of emotion regulation. *Personality and Individual Differences*, *54*, 453–456.

Perri, M. a., & Halford, E. (2004). Pain and faulty breathing: A pilot study. *Journal of Bodywork and Movement Therapies*, *8*, 297–306.

Petersen, S., Orth, B., & Ritz, T. (2008). Awareness of breathing: The structure of language descriptors of respiratory sensations. *Health Psychology*, *27*, 122–127.

Philippot, P., Chapelle, G., & Blairy, S. (2002). Respiratory feedback in the generation of emotion. *Cognition & Emotion*, *16*, 605–627.

Pistole, M. C., & Fitch, J. C. (2008). Attachment theory in supervision: A critical incident experience. *Counselor Education & Supervision*, *47*, 193–205.

Plaza, V., Giner, J., Picado, C., Sureda, B., Serrano, J., Casan, P., … Sanchis, J. (2006). Control of ventilation, breathlessness perception and alexithymia in near-fatal asthma. *The Journal of Asthma*, *43*, 639–644.

Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology*, *74*, 116–143.

Porges, S. W., Doussard-Roosevelt, J. A., & Maiti, A. K. (1994). Vagal tone and the physiological regulation of emotions. *Monographs of the Society for Research in Child Development*, *59*, 167–186.

Ravitz, P., Maunder, R., Hunter, J., Sthankiya, B., & Lancee, W. (2010). Adult attachment measures: A 25-year review. *Journal of Psychosomatic Research*, *69*, 419–32.

Riggs, S. a., & Bretz, K. M. (2006). Attachment processes in the supervisory relationship: An exploratory investigation. *Professional Psychology: Research and Practice*, *37*, 558–566.

Rindfuss, R. R. (1991). The young adult years: Diversity, structural change, and fertility. *Demography*, *28*, 493–512.

Ritz, T. (2004). Probing the psychophysiology of the airways: physical activity, experienced emotion, and facially expressed emotion. *Psychophysiology*, *41*, 809–821.

Ritz, T., Rosenfield, D., Dewilde, S., & Steptoe, A. (2010). Daily mood, shortness of breath, and lung function in asthma: Concurrent and prospective associations. *Journal of Psychosomatic Research*, *69*, 341–351.

Ritz, T., Steptoe, A., DeWilde, S., & Costa, M. (2000). Emotions and stress increase respiratory resistance in asthma. *Psychosomatic Medicine*, *62*, 401–412.

Ritz, T., & Van den Bergh, O. (2010). Psychobiology of respiration and the airways. *Biological Psychology*, *84*, 1–3.

Roberston, J. (1953). Some responses of young children to the loss of maternal care. *Nursing Times*, 382–386.

Roisman, G. I., Tsai, J. L., & Chiang, K.-H. S. (2004). The emotional integration of childhood experience: Physiological, facial expressive, and self-reported emotional response during the adult attachment interview. *Developmental psychology*, *40*, 776–89.

Rottenberg, J., & Gross, J. J. (2007). Emotion and emotion regulation: A map for psychotherapy researchers. *Clinical Psychology: Science and Practice*, *14*, 323–329.

Rowley, J., & Phys, D. (2004). Development of the RoBE self-efficacy scale for people with breathing pattern disorders. *New Zealand Journal of Physiotherapy*, *34*, 131–141.

Sbarra, D. a, & Hazan, C. (2008). Coregulation, dysregulation, self-regulation: An integrative analysis and empirical agenda for understanding adult attachment, separation, loss, and recovery. *Personality and social psychology review : an official journal of the Society for Personality and Social Psychology, Inc*, *12*, 141–67.

Scano, G., Gigliotti, F., Stendardi, L., & Gagliardi, E. (2013). Dyspnea and emotional states in health and disease. *Respiratory Medicine*, *107*, 649–655.

Schein, M. H., Gavish, B., Baevsky, T., Kaufman, M., Levine, S., Nessing, A., & Alter, A. (2009). Treating hypertension in type II diabetic patients with device-guided breathing: A randomized controlled trial. *Journal of Human Hypertension*, *23*, 3253–31.

Schneiderman, I., Zilberstein-Kra, Y., Leckman, J. F., & Feldman, R. (2011). Love alters autonomic reactivity to emotions. *Emotion*, *11*, 1314–1321.

Schore, A. N. (1997). Early organization of the nonlinear right brain and development of a predisposition to psychiatric disorders. *Development and Psychopathology*, *9*, 595–631.

Schore, A. N. (2000). Attachment and the regulation of the right brain. *Attachment & Human Development*, *2*, 23–47.

Schore, A. N. (2001a). Effects of a secure attachment relationship on right brain development, affect regulation and infant mental health. *Infant Mental Health Journal*, *22*, 7–64.

Schore, A. N. (2001b). The effects of early relational trauma on right brain development, affect regulation, and infant mental health. *Infant Mental Health Journal*, *22*, 201–269.

Schore, A. N. (2007). Psychoanalytic research: Progress and process developmental affective neuroscience and clinical practice. *Pscyhologist-Psychoanalyst,* 6–15.

Schore, A. N. (2009a). Attachment trauma and the developing right brain: Origins of pathological dissociation. In P. F. Dell & J. A. O'Neil (Eds.), *Dissociation and the dissociative disorders: DSM-V and beyond* (pp. 107–143). New York: Routledge.

Schore, A. N. (2009b). Relational trauma and the developing right brain: An interface of psychoanalytic self psychology and neuroscience. *Annals of the New York Academy of Sciences, 1159,* 189–203.

Schore, J. R., & Schore, A. N. (2008). Modern attachment theory: The central role of affect regulation in development and treatment. *Clinical Social Work Journal*, *36*, 9–20.

Selhub, E. (2007). Mind-body medicine for treatment depression: Using the mind to alter the body's response to stress. *Alternative and Complementary Therapies, 13*, 4–9.

Shapero, B. G., & Steinberg, L. (2013). Emotional reactivity and exposure to household stress in childhood predict psychological problems in adolescence. *Journal of Youth and Adolescence, 42*, 1573–1582.

Shaver, P. R., & Mikulincer, M. (2010). New directions in attachment theory and research. *Journal of Social and Personal Relationships, 27*, 163–172.

Sibley, C. G., Fischer, R., & Liu, J. H. (2005). Reliability and validity of the Revised Experiences in Close Relationships (ECR-R) self-report measure of adult romantic attachment. *Personality & Social Psychology Bulletin, 31*, 1524–1536.

Silva, J. M. (2012). Constructing Adulthood in an Age of Uncertainty. *American Sociological Review*, *77*, 505–522.

Simonelli, L. E., Ray, W. J., & Pincus, A. L. (2004). Attachment models and their relationships with anxiety, worry, and depression. *Counseling and Clinical Psychology Journal, 1*, 107–118.

Skowron, E. A., & Friedlander, M. L. (1998). The Differentiation of Self Inventory: Development and initial validation. *Journal of Counseling Psychology, 45*, 235–246.

Sloan, D. M., & Kring, A. M. (2010). Introduction and Overview. In A. M. King & D. M. Sloan (Eds.), *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment* (pp. 1–9). New York, NY: Guilford.

Spano, R., Koenig, T. L., Hudson, J. W., & Leiste, M. R. (2010). East meets West: A nonlinear model for understanding human growth and development. *Smith College Studies in Social Work*, *80*, 198–214.

Sroufe, L. A. (2005). Attachment and development: A prospective, longitudinal study from birth to adulthood. *Attachment & Human Development*, *7*, 349–67.

Sroufe, L. A., & Siegel, D. (2011). The verdict is in - The case for attachment theory. *Psychotherapy Networker*, *35*, 34–39.

Stallard, P., Norman, P., Huline-Dickens, S., Salter, E., & Cribb, J. (2004). The effects of parental mental illness upon children: A descriptive study of the views of parents and children. *Clinical Child Psychology and Psychiatry*, *9*, 39–52.

Steele, H., Steele, M., & Croft, C. (2008). Early attachment predicts emotion recognition at 6 and 11 years old. *Attachment & Human Development*, *10*, 379–393.

Stevenson, I., & Ripley, H. S. (1952). Variations in respiration and in respiratory symptoms during changes in emotion. *Psychosomatic Medicine*, *14*, 476–490.

Stifter, C. A., Dollar, J. M., & Cipriano, E. A. (2011). Temperament and emotion regulation: The role of autonomic nervous system reactivity. *Developmental Psychobiology*, *53*, 266–279.

Stöber, J. (2001). The Social Desirability Scale-17: Convergent validity, discriminant validity, and relationship with age. *European Journal of Psychlogical Assessment*, *17*, 222–232.

Strauss, B. M., Mestel, R., & Kirchmann, H. A. (2011). Changes of attachment status among women with personality disorders undergoing inpatient treatment. *Counselling and Psychotherapy Research*, *11*, 275–283.

Suvisaari, J., Aalto-Setälä, T., Tuulio-Henriksson, A., Härkänen, T., Saarni, S. I., Perälä, J., … Lönnqvist, J. (2009). Mental disorders in young adulthood. *Psychological Medicine*, *39*, 287–299.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (Sixth Edit.). Upper Saddle River, New Jersey: Pearson.

Takase, H., & Haruki, Y. (2001). Coordination of breathing between ribcage and abdomen in emotional arousal. In Y. Haruki, I. Homma, A. Umezawa, & Y. Masaoka (Eds.), *Respiration and Emotion* (pp. 75–86). Tokyo, Japan: Springer.

Thayer, J. F., & Lane, R. D. (2000). A model of neurovisceral integration in emotion regulation and dysregulation. *Journal of Affective Disorders*, *61*, 201–216.

Thomas, M., Mckinley, R. K., Freeman, E., & Foy, C. (2001). Prevalence of dysfunctional breathing in patients treated for asthma in primary care: Cross sectional survey. *Brittish Medical Journal*, *322*, 1098–1100.

Thomas, M., McKinley, R. K., Freeman, E., Foy, C., Prodger, P., & Price, D. (2003). Breathing retraining for dysfunctional breathing in asthma: A randomised controlled trial. *Thorax*, *58*, 110–115.

Thompson, R. A., & Goodman, M. (2010). Development of emotion regulation: More than meets the eye. In A. M. Kring & D. M. Sloan (Eds.), *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment* (pp. 38–58). New York, NY: Guilford.

Thomson, P. (2007). "Down will come baby": Prenatal stress, primitive defenses and gestational dysregulation. *Journal of Trauma & Dissociation*, *8*, 37–41.

Tibbetts, V., & Peper, E. (1993). The effects of therapist breathing style on subject's inhalation volumes. *Biofeedback and Self-Regulation*, *18*, 115–120.

Timmons, B. H., & Ley, R. (1994). *Behavioral and psychological approaches to breathing disorders*. New York: Plenum.

Towe-Goodman, N. R., Stifter, C. A., Mills-Koonce, W. R., & Granger, D. A. (2012). Interparental aggression and infant patterns of adrenocortical and behavioral stress responses. *Developmental Psychobiology*, *54*, 685–699.

Travis, L. A., York, N., Bliwise, N. G., Binder, J. L., & Horne-moyer, H. L. (2001). Changes in clients' attachment styles over the course of time-limited dynamic psychotherapy. *Psychotherapy*, *38*, 149–159.

Tsang, H. W. H., Chan, E. P., & Cheung, W. M. (2008). Effects of mindful and non-mindful exercises on people with depression: A systematic review. *The British Psychological Society*, *47*, 303–322.

Uecker, J. E. (2012). Marriage and mental health among young adults. *Journal of health and social behavior*, *53*, 67–83.

Van Dixhoorn, J., & Duivenvoorden, H. J. (1985). Efficacy of Nijmegen questionnaire in recognition of the hyperventilation syndrome. *Journal of Psychosomatic Research*, *29*, 199–206.

Van Doorn, P., Folgering, H., & Colla, P. (1982). Control of the end-tidal PCO2 in the hyperventilation syndrome: Effects of biofeedback and breathing instructions compared. *Clinical Respiratory Physiology*, *18*, 829–836.

Van Dorn, R. A., Kosterman, R., Williams, J. H., Chandler, K., Young, M. S., Catalano, R. F., & Hawkins, J. D. (2010). The relationship between outpatient mental health treatment and subsequent mental health symptoms and disorders in young adults. *Administration and Policy in Mental Health*, *37*, 484–496.

Van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2010). Invariance of adult attachment across gender, age, culture, and socioeconomic status? *Journal of Social and Personal Relationships*, *27*, 200–208.

Vaschillo, E. G., Vaschillo, B., & Lehrer, P. M. (2006). Characteristics of resonance in heart rate variability stimulated by biofeedback. *Applied Psychophysiology and Biofeedback*, *31*, 129–142.

Vasilev, C. a, Crowell, S. E., Beauchaine, T. P., Mead, H. K., & Gatzke-Kopp, L. M. (2009). Correspondence between physiological and self-report measures of emotion dysregulation: A longitudinal investigation of youth with and without psychopathology. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *50*, 1357–1364.

Volling, B. L., Blandon, A. Y., & Kolak, A. M. (2006). Marriage, parenting, and the emergence of early self-regulation in the family system. *Journal of Child and Family Studies*, *15*, 489–502.

Volokhov, R. N., & Demaree, H. A. (2010). Spontaneous emotion regulation to positive and negative stimuli. *Brain and Cognition*, *73*, 1–6.

Ward, S. A., Drysdale, D. B., Cunningham, D. J., & Petersen, E. S. (1979). Inspiratory-expiratory responses to alternate-breath oscillation of PACO2 and PAO2. *Respiration Physiology*, *36*, 311–25.

Wargo, E. (2007). Understanding the have-knots: The role of stress in just about everything. *Observer*, *20*.

Waters, S. F., Virmani, E. A., Thompson, R. A., Meyer, S., Raikes, H. A., & Jochem, R. (2010). Emotion regulation and attachment: Unpacking two constructs and their association. *Journal of Psychopathology and Behavioral Assessment*, *32*, 37–47.

Watson, J. C., McMullen, E. J., Prosser, M. C., & Bedard, D. L. (2011). An examination of the relationships among clients' affect regulation, in-session emotional

processing, the working alliance, and outcome. *Psychotherapy research : journal of the Society for Psychotherapy Research*, *21*, 86–96.

Wei, M., Russell, D. W., Mallinckrodt, B., & Vogel, D. L. (2007). The Experiences in Close Relationship Scale (ECR)-short form: Reliability, validity, and factor structure. *Journal of Personality Assessment*, *88*, 187–204.

Wei, M., Russell, D. W., Mallinckrodt, B., & Zakalik, R. a. (2004). Cultural equivalence of adult attachment across four ethnic groups: Factor structure, structured means, and associations with negative mood. *Journal of Counseling Psychology*, *51*, 408–417.

Wei, M., Vogel, D. L., Ku, T.-Y., & Zakalik, R. a. (2005). Adult Attachment, Affect Regulation, Negative Mood, and Interpersonal Problems: The Mediating Roles of Emotional Reactivity and Emotional Cutoff. *Journal of Counseling Psychology*, *52*, 14–24.

Wei, M., Yu-Hsin Liao, K., Ku, T.-Y., & Shaffer, P. A. (2011). Attachment, self-compassion, empathy, and subjective well-being among college students and community adults. *Journal of Personality*, *79*, 191–221.

Weinfield, N. ., Sroute, L. A., Egeland, B., & Carlson, E. (2008). Individual differences in infant-caregiver attachment. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment theory, research, and clinical applications* (pp. 78–101). New York: Guilford.

Werner, K., & Gross, J. J. (2010). Emotion regulation and psychopathology. In A. M. Kring & D. M. Sloan (Eds.), *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment* (pp. 13–37). New York, NY: Guilford Press.

Wilhelm, F. H., Gevirtz, R., & Roth, W. T. (2001). Respiratory dysregulation in anxiety, funcitonal cardiac, and pain disorders: Assessment, phenomenology, and treatment. *Behavior Modification*, *25*, 513–545.

Wollburg, E., Roth, W. T., & Kim, S. (2011). Effects of breathing training on voluntary hypo- and hyperventilation in patients with panic disorder and episodic anxiety. *Applied Psychophysiology and Biofeedback*, *36*, 81–91.

World Health Organization. (2012). Maternal mental health and child health and development.

World Health Organization (WHO). (1948). WHO definition of Health. Retrieved October 17, 2012, from http://www.who.int/about/definition/en/print.html

World Health Organization (WHO). (2004). *Prevention of mental disorders: Effective intervention and policy options*. Geneva, Switzerland.

World Health Organization (WHO). (2005). *Mental health: Facing the challenges, building solutions*. *Report from the WHO European Ministerial Conference.*

World Health Organization (WHO). (2013a). Depression. Retrieved April 13, 2013, from http://www.who.int/mediacentre/factsheets/fs369/en/index.html

World Health Organization (WHO). (2013b). 10 mental health facts. Retrieved May 05, 2013, from http://www.who.int/features/factfiles/mental_health/mental_health_facts/en/

Wu, A. D., & Zumbo, B. D. (2007). Understanding and using mediators and moderators. *Social Indicators Research*, *87*, 367–392.

Young, J. S., Cashwell, C. S., & Giordano, A. L. (2010). Breathwork as a therapeutic modality: An overview for counselors. *Counseling and Values*, *55*, 113–125.

Zeier, H. (1984). Arousal reduction with biofeedback-supported respiratory meditation. *Biofeedback and Self-Regulation*, *9*, 497–508.

Zeifman, D. M. (2001). An ethological analysis of human infant crying: Answering Tinbergen's four questions. *Developmental Psychobiology*, *39*, 265–285.

Zelenko, M., Kraemer, H., Huffman, L., Gschwendt, M., Pageler, N., & Steiner, H. (2005). Heart rate correlates of attachment status in young mothers and their infants. *Journal of the American Academy of Child and Adolescent Psychiatry*, *44*, 470–476.

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO

OFFICE OF RESEARCH INTEGRITY
2718 Beverly Cooper Moore and Irene Mitchell Moore
Humanities and Research Administration Bldg.
PO Box 26170
Greensboro, NC 27402-6170
336.256.1482
Web site: www.uncg.edu/orc
Federalwide Assurance (FWA) #216

To: Jamie Crockett
Counsel and Ed Development

From: UNCG IRB

Authorized signature on behalf of IRB

Approval Date: 9/09/2013
Expiration Date of Approval: 9/08/2014

RE: Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)
Submission Type: Initial
Expedited Category: 7.Surveys/interviews/focus groups
Study #: 13-0314
Study Title: Investigating the Role of Breathing in Attachment and Emotion regulation

This submission has been approved by the IRB for the period indicated. It has been determined that the risk involved in this research is no more than minimal.

Study Description:

This study will investigate the relationships between adult romantic attachment, symptoms of dysfunctional breathing, and emotion-regulation among a sample of young adults between the ages of 20-35 who report that they have had at least one adult romantic relationship that they consider significant. Participants who choose to participate will complete an online survey comprised of questions designed to assess their attachment style, emotion regulation strategies, symptoms of dysfunctional breathing, and demographic information. The study will be conducted in two phases. In phase one of the study the instrumentation and procedures will be field tested with a small sample. In phase two of the study the final survey will be administered to the full sample.

Regulatory and other findings:

- This research meets criteria for waiver of a signed consent form according to 45 CFR 46.117(c)(2).

Investigator's Responsibilities

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator's responsibility to submit for renewal and obtain approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.

Signed letters, along with stamped copies of consent forms and other recruitment materials will be scanned to you in a separate email. These consent forms must be used unless the IRB hasgiven you approval to waive this requirement.

You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented (use the modification application available at http://integrity.uncg.edu/institutional-review-board/). Should any adverse event or unanticipated problem involving risks to subjects or others occur it must be reported immediately to the IRB using the "Unanticipated Problem-Adverse Event Form" at the same website.
Please be aware that valid human subjects training for all members of research team need to be kept on file with the lead investigator. Please note that you will also need to remain in compliance with the university "Access To and Retention of Research Data" Policy which can be found at http://policy.uncg.edu/research_data/.

CC:
Craig Cashwell, Counsel and Ed Development

APPENDIX B

INFORMED CONSENT

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

CONSENT TO ACT AS A HUMAN PARTICIPANT: LONG FORM

Project Title: Investigating the Role of Breathing in Attachment and Emotion-regulation: A Dissertation Study

Project Director: Jamie Crockett

Faculty Advisor: Dr. Craig Cashwell

What is the study about?
This is a research project. Your participation is voluntary. You are being asked to participate in a research study being conducted by Jamie Crockett and Dr. Craig Cashwell, a student and a faculty member at UNCG, and Dr. Patrick Akos, a faculty member at UNC Chapel Hill. The purpose of this study is to investigate the relationships between attachment, breathing, and emotion-regulation among a sample of young adults.

Why are you asking me?
You are being asked to participate in this study because you are between the ages of 20-35 and have experienced at least one adult romantic relationship that you considered significant.

What will you ask me to do if I agree to be in the study?
We ask that you take approximately 12-30 minutes to complete an online survey. After you finish responding to the survey questions you are done with the study. Most questions will ask you to rate your responses and experiences about either your relationships, emotions, or your breathing. Reflecting on some questions may cause some psychological or emotional discomfort. If at anytime you feel uncomfortable in this study it is your right to withdraw from it at any time without penalty or prejudice.

Is there any audio/video recording?
The use of audio/video recording will NOT be utilized for this study.

What are the dangers to me?
The Institutional Review Board at the University of North Carolina at Greensboro has determined that participation in this study poses minimal risk to participants. You may feel uncomfortable at times answering questions about your relationships, emotions, and breathing. Should you feel uncomfortable answering the questions asked in this study it is your right to choose not to answer questions and withdraw from the study at any time without penalty or prejudice.

The following resources may be helpful if you experience uncomfortable emotions or thoughts that you would like to talk with someone about. If you would like help finding a therapist in your area you may visit http://www.goodtherapy.org or call 1-888-563-2112 ext.1 If you are experiencing suicidal thoughts you may call the National Suicide Prevention Lifeline at 1-800-273-TALK (8255) or chat with them at http://www.suicidepreventionlifeline.org If you are experiencing a life threatening emergency please call 911.

In addition, your personal identification will be safeguarded. Data collected and results of the questionnaire you are about to fill out are anonymous and will be stored in a password-protected file. We will not collect any materials with your identifying information. Should survey information be breached no information on the survey will be directly connected to you, the participant.

If you have any concerns about your rights, how you are being treated, concerns or complaints about this project or benefits or risks associated with being in this study please contact the Office of Research Compliance at UNCG toll-free at (855)-251-2351. If you have questions, want more information or have suggestions please contact Dr. Craig Cashwell at (336) 334-3427 or cscashwe@uncg.edu.

Are there any benefits to society as a result of me taking part in this research?

UNCG IRB
Approved Consent Form
Valid from:
12/5/13 to **9/8/14**

Research in this area may provide numerous benefits for professional counselors in their assessment and treatment of clients who may or may not benefit from breath and attachment related interventions. The results of this study may have implications for integrating the breath and attachment related approaches into assessment, prevention, practice, and research in counseling.

Are there any benefits to *me* for taking part in this research study?
There are no direct benefits to participants in this study.

Will I get paid for being in the study? Will it cost me anything?
There are no costs to you for participating in this study. You will not be paid for participation in this study.

How will you keep my information confidential?
Absolute confidentiality of data provided through the Internet cannot be guaranteed due to the limited protections of Internet access. Please be sure to close your browser when finished so no one will be able to see what you have been doing. You are also advised to clear your browsing history. With this in mind, we are not collecting any identifying information from you that will allow anyone to connect your survey responses to your name. Results of the survey will be stored without any identifying information in an electronic, password-protected file on both the student researcher and the university hard drive. Should survey information be breached, survey data cannot be linked to you because we are not collecting your name or any other identifying information. All information obtained in this study is strictly confidential unless disclosure is required by law.

What if I want to leave the study?
You have the right to refuse to participate or to withdraw at any time, without penalty. If you do withdraw, it will not affect you in any way. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is in a de-identifiable state.

What about new information/changes in the study?
If significant new information relating to the study becomes available which may relate to your willingness to continue to participate, this information will be provided to you.

Voluntary Consent by Participant:
Your signature is not required to participate in this study. A waiver of signed consent has been granted by the university IRB. By participating in this study, you are agreeing that you read, or it has been read to you, and you fully understand the contents of this document and are openly willing consent to take part in this study. All of your questions concerning this study have been answered. By participating, you are agreeing that you are 20 years of age or older and are agreeing to participate in this study.

By clicking "Accept" below you are acknowledging that you have read the above statement and are willing to be in the study. You may use the buttons in the upper right corner of this pdf-viewer to print or download this document for your records.

APPENDIX C

RECRUITMENT MESSAGES

General Email Recruitment Script

Recruitment Message

A research team with University of North Carolina at Greensboro in Greensboro, NC, is conducting the following study:

Investigating the Role of Breathing in Attachment and Emotion-regulation: A Dissertation Study

You are invited to participate in this research project if you:

- are an adult between the ages of 20-35
- have at least an 8th grade reading level
- have experienced at least one adult romantic relationship

The purpose of this study is to investigate the relationships between adult romantic attachment, breathing, and emotion-regulation among a sample of young adults. If you choose to learn more about participating in this study you will be redirected to an informed consent document which will further describe the study including risks and benefits. If you agree to participate in the study after reading the informed consent you will then complete an online survey that will take approximately 30 minutes or less to complete. After you finish the survey you will be done with the study. Most survey questions ask you to rate your responses and experiences about your relationships, emotions, or breathing.

If you are interested in this study please select the "Yes, I'm interested" link below. By clicking the "Yes, I'm interested" link, you will be redirected to the informed consent. If you do not wish to participate you may delete or disregard this email. Do not respond to this study message

Yes, I'm interested!

(Or copy and paste link https://uncg.qualtrics.com/SE/?SID=SV_2caRX3WX3xsDe5f

RearchMatch.org Recruitment and Participation Messages

ResearchMatch Recruitment Message

A research team with University of North Carolina at Greensboro in Greensboro, NC, believes you might be a good match for the following study:

Investigating the Role of Breathing in Attachment and Emotion-regulation: A Dissertation Study

You are invited to participate in this research project if you:

- are an adult between the ages of 20-35
- have experienced at least one adult romantic relationship

The purpose of this study is to investigate the relationships between adult romantic attachment, breathing, and emotion-regulation among a sample of young adults. If you choose to learn more about participating in this study you will receive an email from the research team with a link to an informed consent document which will further describe the study including risks and benefits. If you agree to participate in the study after reading the informed consent you will then complete an online survey that will take approximately 15-35 minutes or less to complete. After you finish the survey you will be done with the study. Most survey questions ask you to rate your responses and experiences about your relationships, emotions, or breathing.

If you are interested in this study and having the research team contact you directly, please select the "Yes, I'm interested" link below. By clicking the "Yes, I'm interested" link, your contact information will be released to the research team. If you select the "No, thanks." link or do not respond to this study message, your contact information will not be released to the research team.

Yes, I'm interested! No, thanks.

You are receiving this email message since you have registered in the ResearchMatch registry. Should you wish to edit your profile or remove your contact information from this registry, please login here.

[IF PARTICIPANTS SELECT "YES, I'M INTERESTED" THEY WILL BE RECEIVE AN EMAIL FROM THE PI WITH THE FOLLOWING PARTICIPATION MESSAGE]

Participation Message

You are receiving this email because you indicated to researchmatch.org that you are interested in participating in the study: Investigating the Role of Breathing in Attachment and Emotion-regulation: A Dissertation Study, being conducted by a research team with University of North Carolina at Greensoboro in Greensoboro, NC. If you agree to participate after you have read the informed consent you will be redirected to complete the online survey. To learn more about this study click the link to be redirected to the informed consent.

"Yes, I'm interested."

APPENDIX D

EXPERIENCES IN CLOSE RELATIONSHIP REVISED

We are interested in how you *generally* experience romantic relationships, not just in what is happening in a current relationship. Respond to each statement by indicating how much you agree or disagree with the statement.

	Strongly disagree						**Strongly Agree**
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. I'm afraid that I will lose my partner's love.							
2. I often worry that my partner will not want to stay with me.							
3. I often worry that my partner doesn't really love me.							
4. I worry that romantic partners won't care about me as much as I care about them.							
5. I often wish that my partner's feelings for me were as strong as my feelings for him or her.							
6. I worry a lot about my relationships.							
7. When my partner is out of sight, I worry that he or she might become interested in someone else.							
8. When I show my feelings for romantic partners, I'm afraid they will not feel the same about me.							
9. I rarely worry about my partner leaving me.*							
10. My romantic partner makes me doubt myself.							
11. I do not often worry about being abandoned. *							
12. I find that my partner(s) don't want to get as close as I would like.							
13. Sometimes romantic partners change their feelings about me for no apparent reason.							
14. My desire to be very close sometimes scares people away.							
15. I'm afraid that once a romantic partner gets to know me, he or she won't like who I really am.							
16. It makes me mad that I don't get the affection and support I need from my partner.							
17. I worry that I won't measure up to other people.							
18. My partner only seems to notice me when I'm angry.							
19. I prefer not to show a partner how I feel deep down.							
20. I feel comfortable sharing my private thoughts and feelings with my partner.*							
21. I find it difficult to allow myself to depend on romantic partners.							

22. I am very comfortable being close to romantic partners.*							
23. I don't feel comfortable opening up to romantic partners.							
24. I prefer not to be too close to romantic partners.							
25. I get uncomfortable when a romantic partner wants to be very close.							
26. I find it relatively easy to get close to my partner. *							
27. It's not difficult for me to get close to my partner.*							
28. I usually discuss my problems and concerns with my partner.*							
29. It helps to turn to my romantic partner in times of need.*							
30. I tell my partner just about everything.*							
31. I talk things over with my partner.*							
32. I am nervous when partners get too close to me.							
33. I feel comfortable depending on romantic partners.*							
34. I find it easy to depend on romantic partners.*							
35. It's easy for me to be affectionate with my partner.*							
36. My partner really understands me and my needs.*							

The Attachment Anxiety scale includes items 1-18, the Attachment Avoidance Scale includes items 19-36. *Items are reverse scored.

APPENDIX E

NIJMEGEN QUESTIONNAIRE

Please select how often you experience the symptoms listed below.

	0 (Never)	**1** (Seldom)	**2** (Sometimes)	**3** (Often)	**4** (Very Often)
1. Chest pain					
2. Feeling tense					
3. Blurred vision					
4. Dizziness					
5. Confusion or loss of touch with reality					
6. Fast or deep breathing					
7. Shortness of breath					
8. Tightness across chest					
9. Bloated sensation in stomach					
10. Tingling in fingers and hands					
11. Difficulty in breathing or taking a deep breath					
12. Stiffness or cramps in fingers and hands					
13. Tightness around the mouth					
14. Cold hands or feet					
15. Palpitations in the chest					

APPENDIX F

SELF-EVALUATION OF BREATHING QUESTIONNAIRE VERSION 2

Please indicate how often you experience the symptoms listed below (how true the statements are for you).

	0 (never/ not true at all)	**1** occasionally/a bit true;	**2** (frequently/mostly true)	**3** (very frequently/very true)
1. I get easily breathless out of proportion to my fitness				
2. I notice myself breathing shallowly				
3. I get short of breath reading and talking				
4. I notice myself sighing				
5. I notice myself yawning				
6. I feel I cannot get a deep or satisfying breath				
7. I notice that I am breathing irregularly				
8. My breathing feels stuck or restricted				
9. My rib cage feels tight and can't expand				
10. I notice that I am breathing quickly				
11. I get breathless when I am anxious				
12. I find myself holding my breath				
13. I feel breathless in association with other physical symptoms				
14. I have trouble coordinating my breathing when I am speaking				
15. I can't catch my breath				
16. I feel that the air is stuffy, as if not enough air in the room				
17. I get breathless even when I am resting				

18. My breath feels like it does not go in all the way 19. My breath feels like it does not go out all the way 20. My breathing is heavy 21. I feel that I am breathing more 22. My breathing requires work 23. My breathing requires effort 24. I find myself breathing through my mouth during the day 25. I breathe through my mouth at night while I sleep				

APPENDIX G

DIFFICULTIES IN EMOTION REGULATION SCALE

Please indicate how often the following statements apply to you by selecting the appropriate number from the scale below on the line beside each item.

	1 (Almost Never)	2 (Some times)	3 (About half the time)	4 (Most of the time)	5 (Almost Never)
1. I am clear about my feelings.					
2. I pay attention to how I feel.					
3. I experience my emotions as overwhelming and out of control.					
4. I have no idea how I am feeling.					
5. I have difficulty making sense out of my feelings.					
6. I am attentive to my feelings.					
7. I know exactly how I am feeling.					
8. I care about what I am feeling.					
9. I am confused about how I feel.					
10. When I'm upset, I acknowledge my emotions.					
11. When I'm upset, I become angry with myself for feeling that way.					
12. When I'm upset, I become embarrassed for feeling that way.					
13. When I'm upset, I have difficulty getting work done.					
14. When I'm upset, I become out of control.					
15. When I'm upset, I believe that I will remain that way for a long time.					
16. When I'm upset, I believe that I'll end up feeling very depressed.					
17. When I'm upset, I believe that my feelings are valid and important.					
18. When I'm upset, I have difficulty focusing on other things.					
19. When I'm upset, I feel out of control..					
20. When I'm upset, I can still get things done.					
21. When I'm upset, I feel ashamed with myself for feeling that way.					
22. When I'm upset, I know that I can find a way to eventually feel better.					
23. When I'm upset, I feel like I am weak.					
24. When I'm upset, I feel like I can remain in control of my behaviors.					
25. When I'm upset, I feel guilty for feeling that way.					
26. When I'm upset, I have difficulty concentrating.					
27. When I'm upset, I have difficulty controlling my behaviors.					
28. When I'm upset, I believe there is nothing I can do to make myself feel better.					

29. When I'm upset, I become irritated with myself for feeling that way. 30. When I'm upset, I start to feel very bad about myself. 31. When I'm upset, I believe that wallowing in it is all I can do. 32. When I'm upset, I lose control over my behaviors. 33. When I'm upset, I have difficulty thinking about anything else. 34. When I'm upset, I take time to figure out what I'm really feeling. 35. When I'm upset, it takes me a long time to feel better. 36. When I'm upset, my emotions feel overwhelming.					

Items by scale:

AWARENESS SCALE

I am attentive to my feelings.*

I pay attention to how I feel.*

When I'm upset, I acknowledge my emotions.*

When I'm upset, I believe that my feelings are valid and important.*

I care about what I am feeling.*

When I'm upset, I take time to figure out what I'm really feeling.*

CLARITY SCALE

I have difficulty making sense out of my feelings.

I have no idea how I am feeling.

I am confused about how I feel.

I know exactly how I am feeling.*

I am clear about my feelings.*

GOALS SCALE

When I'm upset, I have difficulty concentrating.

When I'm upset, I have difficulty focusing on other things.

When I'm upset, I have difficulty getting work done.

When I'm upset, I have difficulty thinking about anything else.

When I'm upset, I can still get things done.*

IMPULSIVITY SCALE

When I'm upset, I lose control over my behaviors.

When I'm upset, I have difficulty controlling my behaviors.

When I'm upset, I become out of control.

When I'm upset, I feel out of control.

I experience my emotions as overwhelming and out of control.

When I'm upset, I feel like I can remain in control of my behaviors.*

NONACCEPTANCE SCALE

When I'm upset, I feel guilty for feeling that way.

When I'm upset, I feel ashamed with myself for feeling that way.

When I'm upset, I become embarrassed for feeling that way.

When I'm upset, I become angry with myself for feeling that way.

When I'm upset, I become irritated with myself for feeling that way.

When I'm upset, I feel like I am weak.

STRATEGIES SCALE

When I'm upset, I believe that I'll end up feeling very depressed.

When I'm upset, I believe that I will remain that way for a long time.

When I'm upset, I believe that wallowing in it is all I can do.

When I'm upset, it takes me a long time to feel better.

When I'm upset, I believe there is nothing I can do to make myself feel better.

When I'm upset, I know that I can find a way to eventually feel better.*

When I'm upset, my emotions feel overwhelming.

When I'm upset, I start to feel very bad about myself.

*Items reverse scored.

APPENDIX H

SOCIAL DESIRABILITY SCALE – 16

Below you will find a list of statements. Please read each statement carefully and decide if that statement describes you or not. If it describes you, check the word "true"; if not, check the word "false."

1. I sometimes litter.	True	False
2. I always admit my mistakes openly and face the potential negative consequences.	True	False
3. In traffic I am always polite and considerate of others.	True	False
4. I always accept others' opinions, even when they don't agree with my own.	True	False
5. I take out my bad moods on others now and then.	True	False
6. There has been an occasion when I took advantage of someone else.	True	False
7. In conversations I always listen attentively and let others	True	False
8. I never hesitate to help someone in case of emergency.	True	False
9. When I have made a promise, I keep it – no ifs, ands or buts.	True	False
10. I occasionally speak badly of others behind their back.	True	False
11. I would never live off other people.	True	False
12. I always stay friendly and courteous with other people, even when I am stressed	True	False
out.	True	False
13. During arguments I always stay objective and matter-of-fact.	True	False
14. There has been at least one occasion when I failed to return an item that I	True	False
borrowed.	True	False
15. I always eat a healthy diet.		
16. Sometimes I only help because I expect something in return.		

APPENDIX I

DEMOGRAPHICS QUESTIONNAIRE

1. Do you smoke?
    a. No
    b. I did but I quit
        i. For how long did you smoke? _____
        ii. How long has it been since you quit? _____
    c. Yes
        i. For how long have you been a smoker? _____
        ii. How much do you smoke? _____

2. How much caffeine to you consume?
    a. None
    b. 1 serving per day
    c. 2 servings per day
    d. 3-5 servings per day
    e. 6 or more servings per day

3. Do you have a current diagnosis of a breathing problem?
    a. No
    b. Asthma
    c. COPD
    d. Other (please specify)_____

4. Do you have a current diagnosis of a heart problem?
    a. No
    b. Heart disease
    c. Hypertension
    d. Poor circulation
    e. Other (please specify)_____

5. Do you currently practice (select all that apply)
    a. Breath exercises
    b. Yoga
    c. Mindfulness
    d. Tai Chi
    e. Qigong
    f. Pilates
    g. Other mind-body practice (please specify)_____
    h. None

6. Please describe your weight
    a. Healthy weight
    b. Underweight
    c. Overweight by 10-25 lbs
    d. Overweight by 26-50 lbs
    e. Overweight by 51-75 lbs.
    f. Overweight by 76 lbs or more

7. Do you do breathing exercises?
    a. No
    b. Yes
        i. If so what do you do?
        ii. How often?

8. Do you sing regularly?
    a. Yes
    b. No

9. Have you ever had singing lessons/voice training?
    a. Yes
    b. No

10. Are you pregnant?
    a. No
    b. Yes 1st trimester
    c. Yes 2nd trimester
    d. Yes 3rd trimester

11. Do you exercise regularly?
    a. No
    b. Yes
        i. If yes how many hours on average do you engage in exercise per week?

12. What is your age?

13. What is your race/ethnicity?
    a. African-American/Black
    b. Asian
    c. Caucasian/White
    d. Latino/a
    e. Native American
    f. Other (please specify)

14. What is your gender?
    a. Female
    b. Male
    c. Transgender Female
    d. Transgender Male
    e. Intersex
    f. Other (please specify)_____

15. What is your sexual orientation?
    a. Heterosexual
    b. Homosexual
    c. Bisexual
    d. Other (please specify)_____

16. What is your relationship status?
    a. Single
    b. In a committed relationship – not living together
    c. In a committed relationship – living together
    d. Married or civil partnership
    e. Separated or divorced
    f. Widowed

17. How long have you been in your current relationship?
    a. I am not currently in a relationship
    b. Less than 6 months
    c. 6-12 months
    d. _____ years

18. What is the highest level of education that you have completed?
    a. Grammar school
    b. High school or equivalent
    c. Vocational/technical school
    d. Some college
    e. Bachelor's degree
    f. Master's degree
    g. Doctoral degree
    h. Professional degree (MD, JD, etc.)
    i. Other_____

19. Are you (check all that apply):

    a) I am neither a parent nor a caregiver to a child(ren)
    b) I am a biological parent
    c) I am an adoptive parent
    d) I am a step-parent
    e) I am a parent's partner (living together)
    f) I am a foster parent
    g) I am another type of parent or caregiver (please describe)

APPENDIX J

PILOT STUDY FEEDBACK QUESTIONS

Open-ended questions about the survey:

1. How long did it take to you to complete this survey? ____minutes
2. Were there any survey sections in which the content or directions were unclear to you?
3. Were there any specific questions that were unclear to you?
4. Do you have any recommendations for how to make this survey easier to complete?

APPENDIX K

EVIDENCE THE EXPERIENCES IN CLOSE

RELATIONSHIP REVISED IS NOT COPYRIGHTED

http://internal.psychology.illinois.edu/~rcfraley/measures/ecrr.htm

Information on the Experiences in Close Relationships-Revised (ECR-R) Adult Attachment Questionnaire

---

R. Chris Fraley
University of Illinois at Urbana-Champaign

Q: Do I need permission to use these scales in my research?

A: No. The scales were published in a scientific journal for use in the public domain. You do not need to contact any of the authors for permission to use these scales in non-commercial research. You may *not* use the scales for commercial purposes without permission.

APPENDIX L

EVIDENCE THE NIJMEGEN QUESTIONNAIRE IS NOT COPYRIGHTED

Gmail by Google

Jamie Crockett <jama0517@gmail.com>

information about permission to use Nijmegen Questionnaire
2 messages

Jamie Crockett <jecrock2@uncg.edu> Sun, Nov 3, 2013 at 9:22 AM
To: vdixhoorn@euronet.nl

Dear Dr. van Dixhoorn,

I am a doctoral student at the University of North Carolina Greensboro in Greensboro North Carolina, USA, and I am conducting a dissertation study entitled Investigating the Role of Breathing in Attachment and Emotion-regulation. I would like to use the Nijmegen Questionnaire and am having difficulty locating the contact information of any of the authors (van Doorn, P.,Folgering, H. or Colla, P.) in order to request permission. I understand that you have utilized this instrument and I am writing to inquire if you have any information about how to obtain permission to use the NQ?

Thank you,
Jamie Crockett

--
Jamie Crockett, MS, LPCA, NCC

Doctoral Student | Counseling and Counselor Education
Department of Counseling & Educational Development
The University of North Carolina at Greensboro
jecrock2@uncg.edu

"You are not a drop in the ocean... You are the entire ocean in a drop." ~ Rumi

J. van Dixhoorn <j.dixhoorn@versatel.nl> Tue, Nov 5, 2013 at 8:32 AM
To: Jamie Crockett <jecrock2@uncg.edu>

Dear Jamie

Nijmegen Questionnaire is not copyrighted and free to use

I would be interested in the results of your study!

Yours

Jan van Dixhoorn

Van: jama0517@gmail.com [mailto:jama0517@gmail.com] **Namens** Jamie Crockett
Verzonden: zondag 3 november 2013 15:23
Aan: vdixhoorn@euronet.nl
Onderwerp: information about permission to use Nijmegen Questionnaire

[Quoted text hidden]

APPENDIX M

PERMISSION TO USE THE SELF-EVALUATION OF BREATHING QUESTIONNAIRE VERSION 2

Gmail by Google

Jamie Crockett <jama0517@gmail.com>

Request permission to use the SEBQ-2
2 messages

Jamie Crockett <jecrock2@uncg.edu> Sun, Nov 3, 2013 at 8:07 AM
To: Rosalba Courtney <courtney2107@optusnet.com.au>

Dear Dr. Courtney,

I am a doctoral student at the University of North Carolina Greensboro and I am conducting a dissertation study entitled Investigating the Role of Breathing in Attachment and Emotion-regulation. I used the SEBQ in a previous study with your permission and I am now writing to request your permission to use the Self-Evaluation of Breathing Questionnaire-2 in this dissertation study.

Thank you,

Jamie Crockett, MS, LPCA, NCC

Doctoral Student | Counseling and Counselor Education
Department of Counseling & Educational Development
The University of North Carolina at Greensboro
jecrock2@uncg.edu

Rosalba Courtney <courtney2107@optusnet.com.au> Mon, Nov 4, 2013 at 5:44 AM
To: Jamie Crockett <jecrock2@uncg.edu>

Yes Jamie you have my permission.

Rosalba

Dr. Rosalba Courtney N.D. D.O. PhD

Breath and Body Health

Osteopathy, Breathing Therapy and Integrative Medicine

11 Binburra Ave,

APPENDIX N

PERMISSION TO USE THE DIFFICULTIES IN EMOTION REGULATION SCALE

Gmail by Google

Jamie Crockett <jama0517@gmail.com>

Request permission to use DERS
2 messages

Jamie Crockett <jecrock2@uncg.edu> Sun, Nov 3, 2013 at 8:03 AM
To: KLGratz@aol.com

Dear Dr. Gratz,

I am a doctoral student at the University of North Carolina Greensboro and I am conducting a dissertation study entitled Investigating the Role of Breathing in Attachment and Emotion-regulation. I am writing to request your permission to use the Difficulties in Emotion Regulation Scale in this study.

Thank you,

Jamie Crockett, MS, LPCA, NCC

Doctoral Student | Counseling and Counselor Education
Department of Counseling & Educational Development
The University of North Carolina at Greensboro
jecrock2@uncg.edu

"You are not a drop in the ocean... You are the entire ocean in a drop." ~ Rumi

Kim Gratz <klgratz@aol.com> Sun, Nov 3, 2013 at 4:30 PM
To: Jamie Crockett <jecrock2@uncg.edu>

Feel free to use the DERS

Sent from my iPhone
[Quoted text hidden]

APPENDIX O

PERMISSION TO USE THE SOCIAL DESIRABILITY SCALE – 16

Gmail by Google

Jamie Crockett <jama0517@gmail.com>

Request permission to use the Social Desirability Scale
2 messages

Jamie Crockett <jecrock2@uncg.edu> Sun, Nov 3, 2013 at 8:14 AM
To: J.Stoeber@kent.ac.uk

Dear Dr. Stoeber,

I am a doctoral student at the University of North Carolina Greensboro in Greensboro North Carolina, and I am conducting a dissertation study entitled Investigating the Role of Breathing in Attachment and Emotion-regulation. I would like to use the Social Desirability Scale -17 and am writing to request your permission to use this instrument in this study.

Thank you,

--
Jamie Crockett, MS, LPCA, NCC

Doctoral Student | Counseling and Counselor Education
Department of Counseling & Educational Development
The University of North Carolina at Greensboro
jecrock2@uncg.edu

"You are not a drop in the ocean... You are the entire ocean in a drop." ~ Rumi

Joachim Stoeber <J.Stoeber@kent.ac.uk> Sun, Nov 3, 2013 at 8:16 AM
To: Jamie Crockett <jecrock2@uncg.edu>

Hello Jamie: Permission granted. All best, Joachim

Sent from my mobile
[Quoted text hidden]

APPENDIX P

RECRUITMENT APPROVAL THROUGH RESEARCHMATCH.ORG

Gmail by Google

Jamie Crockett <jama0517@gmail.com>

ResearchMatch: Action Required - IRB # 130314
1 message

info@researchmatch.org <info@researchmatch.org> Mon, Sep 23, 2013 at 4:33 PM
Reply-To: info@researchmatch.org
To: jecrock2@uncg.edu

Congratulations. Your ResearchMatch Institutional Liaison has approved your recruitment access request for IRB Study #: **130314**, titled: **Investigating the role of breathing in attachment and emotion regulation** at the following institution: **University of North Carolina at Chapel Hill**.

Before your ResearchMatch account is enabled with recruitment access, you MUST accept this access.

By clicking Accept, your username and password that you created upon registering as a researcher in ResearchMatch will be enabled to give you this recruitment access. In other words, you will be able to search the ResearchMatch registry and contact potential study participants that match your study criteria.

Accept – I wish to recruit study participants through ResearchMatch

If you no longer wish to use ResearchMatch as a recruitment tool, please select the following:

Deny - I no longer wish or need to use ResearchMatch as a recruitment tool

Thank you for your interest in ResearchMatch. It is our hope that this recruitment tool will prove useful to your research endeavors.

Best wishes,
ResearchMatch.org

Please visit www.researchmatch.org for more information or contact info@researchmatch.org should you have any questions or concerns.

If you did not submit this recruitment access request, please click here.

APPENDIX Q

PERMISSION TO RECRUIT THROUGH CED

Gmail by Google

Jamie Crockett <jama0517@gmail.com>

permission to recruit
2 messages

Jamie Crockett <jecrock2@uncg.edu> Wed, Oct 9, 2013 at 1:48 PM
To: "Dr J. Scott Young" <JSYOUNG3@uncg.edu>

Hi Dr Young,
I am writing to ask your permission to recruit participants for the research project "Investigating the Role of Breathing in Attachment and Emotion-regulation: A dissertation study" using the CED listservs. Attached is the most recent informed consent for your review.
Thank you,
Jamie

--
Jamie Crockett, MS, LPCA, NCC

Doctoral Student | Counseling and Counselor Education
Department of Counseling & Educational Development
The University of North Carolina at Greensboro
jecrock2@uncg.edu

"You are not a drop in the ocean... You are the entire ocean in a drop." ~ Rumi

IRB_InformedConsent - Modified.docx
23K

John Young <jsyoung3@uncg.edu> Wed, Oct 9, 2013 at 1:49 PM
To: Jamie Crockett <jecrock2@uncg.edu>

Jamie,
You have my permission, best of luck with your research!
[Quoted text hidden]
--
J. Scott Young, PhD, Professor and Chair
Department of Counseling and Educational Development
The University of North Carolina at Greensboro
222 Curry Building / PO Box 26170 / Greensboro, NC 27402-6170
Office: 336-334-3464 / Fax:336-334-3433 / Email: jsyoung3@uncg.edu
Office Managers Phone: 336-334-3423
Visit us on Facebook at: http://www.facebook.com/pages/UNCG-Department-of-Counseling-and-Educational-Development/306293056090011

IRB_InformedConsent - Modified.docx
23K

APPENDIX R

PILOT STUDY RESULTS

A pilot study was conducted to assess the procedures of the study. With the exception of research question 2, the research questions and hypotheses for the full study were used in the pilot study. The following sections report information on the participants, instrumentation, procedures, and results of the pilot study.

Participants

The sample for the pilot study consisted of 13 individuals between the ages of 22 and 32 with a mean age of 25.85 (*SD* = 3.21) who have experienced at least one adult romantic relationship. The majority of participants were female (*n* = 11; 84.6%) and the remaining 15.4% identified as male. Most participants' (*n* = 9; 69.2%) current romantic relationship have spanned 1 or more years with a mean of 3.11 years, two participants (15.4%) reported current relationships of 6 to 12 months, one participant (7.7%) reported less than 6 months and one participant (7.7%) reported being currently single. Complete demographic information is reported in Table 22.

Instrumentation

The instrumentation for the pilot study consisted of six measures (a) demographic questionnaire, (b) Experiences in Close Relationship Revised (ECR-R; Fraley, Waller, & Brennan, 2000), (c) Nijmegen Questionnaire (NQ; van Doorn, Folgering, & Colla, 1982), (d) Self-evaluation of Breathing Questionnaire Version 2 (SEBQ-2; Courtney & Greenwood, 2009), (e) Difficulties in Emotion Regulation Scale (DERs; Gratz & Roemer, 2004), and the (f) Social Desirability Scale – 16 (Stöber, 2001). Additionally,

the final section of the survey consisted of four open-ended questions designed to assess the ease of survey completion including time to complete, clarity of directions and items, and any recommendations to increase the ease of survey completion. The instructions, items, and scoring information for these instruments are provided in Appendix D through H. The Cronbach's alpha levels for this sample are provided in table 23. The alpha levels for both the Anxiety ($\alpha = .93$) and Avoidance ($\alpha = .95$) scales of the ECR-R were found to be acceptable. The alpha levels for the DERS total score ($\alpha = .96$) and scales of NONACCEPTANCE ($\alpha = .96$), GOALS ($\alpha = .94$), STRATEGIES ($\alpha = .92$), and CLARITY ($\alpha = .834$) were found to be acceptable while the scale of IMPULSIVITY ($\alpha = .10$) and AWARENESS ($\alpha = .63$) were not within an acceptable range. Alphas were calculated for each of the study variables for participants in the full study.

Procedures

After obtaining approval from the Institutional Review Board (IRB) at The University of North Carolina at Greensboro (UNCG), the researcher registered the research study with ResearchMatch.org. Due to delays in the contract between ResearchMatch.org and the office of grants and contracts at UNCG, the researcher elected to utilize an alternative recruitment strategy for the pilot study. After obtaining approval from the IRB at UNCG, the researcher contacted the chair of the Department of Counseling and Educational Development (CED) to request permission to utilize the department's listserve to recruit participants. After permission was received, the researcher emailed an invitation to participate in the study through the CED listserv for current master's and doctoral students. Individuals who chose to participate followed an

online Qualtrics link that provided the informed consent document describing the nature of the study, potential risks, confidentiality, voluntary participation, and researcher contact information for related questions. Participants that indicated agreement to participate after completing the informed consent were redirected to the web-based survey. The participants then completed the online survey packet comprised of the demographic questionnaire, the ECR-R, SEBQ-2, NQ, DERS, SDS-16, and the four open-ended feedback questions. According to participant self-report, the majority of participants completed the survey in 20 minutes or less (n = 10; 76.92%), the shortest completion time was 15 minutes (n = 3; 23.1%) and the longest was 35 minutes (n = 1; 7.7%) with a mean completion time of 20.93 minutes.

Table 22

Pilot Study Sample Demographics

Variable	**Mean (Range)**	***n***	**%**
Age	25.85 (22-32)	13	
Race/Ethnicity			
African-American/Black		1	7.7
Caucasian/White		11	84.6
Other (please specify)			
Biracial (Self-specified)		1	7.7
Gender			
Female		11	84.6
Male		2	15.4
Sexual Orientation			
Heterosexual		12	92.3
Other (did not specify)		1	7.7

Table 22 Continued

Variable	Mean (Range)	*n*	%
Education			
Bachelor's degree		8	61.5
Master's degree		5	38.5
Relationship Status			
Single		1	7.7
In a committed relationship		6	46.2
In a committed relationship co-habitating		3	23.1
Married/Civil partnership		3	23.1
Relationship Timing			
Not currently in a relationship		1	7.7
Less than 6 months		2	15.4
6-12 months		1	7.7
_____ years	3.11 (1.5-6)	9	69.2
Weight			
Healthy weight		9	69.2
Underweight		2	15.4
Overweight by 10-25lbs		2	15.4
Currently practices			
Breathwork		5	38.5
Yoga		5	38.5
Mindfulness		9	69.2
Practices breathing exercises		4	30.8
Exercise regularly			
Yes		4	30.8
No		9	69.2
Sings regularly			
Yes		6	46.2
No		7	53.8
Voice training			
Yes		7	53.8
No		6	46.2
Pregnancy			
No		13	100

Table 22 Continued

Variable	Mean (Range)	*n*	%
Caffeine consumption			
None		3	23.1
1 serving per day		3	23.1
2 servings per day		4	30.8
3-5 servings per day		3	23.1
Smoking Status			
Non-smoker		13	100

Table 23

Pilot Study Means, Standard Deviations, Cronbach's Alpha, and # Items

Variable	M	SD	Frequency	*α*	# of items
ECR-R					
ANXIETY	60.15	20.23		.93	18
AVOIDANCE	62.46	20.40		.95	18
DERS					
TOTAL	89.62	23.88		.96	36
NONACCEPTANCE	17.08	6.75		.96	6
GOALS	15.92	5.36		.94	5
IMPULSE	13.15	2.44		.10	6
AWARENESS	12.31	2.93		.63	6
STRATEGIES	19.54	6.90		.92	8
CLARITY	11.62	3.62		.83	5
SDS-16					
TOTAL	7.92	2.29		.40	16
SEBQ-2					
TOTAL	52.38	10.63		.89	25
NQ					
TOTAL	34.00	8.74		.86	16
Total < 11			0		
Total 11-22			1		
Total > 22			12		

Data Analysis and Results

Data was collected using the secure online Qualtrics platform. Once data collection was completed, the data was downloaded into an Excel spreadsheet. SPSS version 19 and SAS 9.3 were used to conduct data analyses. SAS 9.3 was used to test for multivariate outliers, univariate and multivariate normality, and in the analyses of research question 3. SPSS 19 was used for all other analyses. Although the sample size was too small for meaningful interpretation of the results, analyses were run for each research question and hypothesis of the study (shown in Table 1) with the exception of research question 2. Nearly all participants (n = 12; 92.31%) reported symptoms of hyperventilation above the cut-off indicative of clinically significant hyperventilation symptoms so there were not sufficient group membership for the categories of clinically normal or mild symptoms to conduct the data analysis for research question 2.

Preliminary analyses, including correlations, were conducted to verify the assumptions of univariate and multivariate multiple regression analysis (e.g., normality, linearity, homoscedasticity, and multicollinearity) before proceeding with the analyses. No assumption violations were identified and there were no significant univariate or multivariate outliers for the SEBQ-2, ECR-R, NQ, SDS-16, and DERS. Though there were no significant issues of multicollinearity in the preliminary analysis of tolerance and VIF values, high correlations among variables could lead to issues of multicollinearity in the analysis of research questions 3, 4 and 5. Any issues of multicollinearity are reported with the analyses of each these research questions. For this sample, acceptable reliability was found for each instrument with the exception of the DERS subscales of Impulsivity

(α = .10) and Awareness (α = .63). Table 23 shows the means and standard deviations (or frequencies, as appropriate) and Cronbach's alpha levels for each variable, correlations are shown in Table 24.

Research question 1. The Pearson product-moment (for continuous variables), and point-biserial (for dichotomous variables) correlations that were used in the analysis of hypotheses 1.1, 1.2, 1.3, and 1.4 are shown in Table 24. In the pilot study data the variable of breath diagnosis was dichotomous (no diagnosis *n* = 11 and asthma *n* = 2) however it is possible that in the full study there may be as many as 4 categories (no diagnosis, asthma, COPD, and other). There were significant positive relationships between Attachment Anxiety and Attachment Avoidance ($r = .67$, $p < .05$); the DERS total score ($r = .58$, $p < .05$) and the DERS subscales of Clarity ($r = .58$, $p < .05$) and Goals ($r = .57$, $p < .05$); symptoms of hyperventilation (NQ score; $r = .59$, $p < .05$); and diagnosis of breathing problem ($r = .64$, $p < .05$). There were significant positive relationships between symptoms of dysfunctional breathing (SEBQ-2 total score) and the DERS total score ($r = .78$, $p < .01$); the DERS subscales of Nonacceptance ($r = .74$, $p < .01$), Goals ($r = .81$, $p < .01$), and Strategies ($r = .72$, $p < .01$); and symptoms of hyperventilation (NQ; $r = .74$, $p < .01$). There also were significant positive relationships between symptoms of hyperventilation (NQ total score) and DERS total score ($r = .75$, $p < .01$), DERS subscales of Clarity ($r = .71$, $p < .01$), Goals ($r = .77$, $p < .01$), Nonacceptance ($r = .67$, $p < .01$), and Strategies ($r = .67$ $p < .05$).

Table 24

Pilot Study Correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. A_ANX	1													
2. A_AVD	.67*	1												
3. ER_CLR	.58*	.15	1											
4. ER_NOA	.46	.44	.57*	1										
5. ER_GOL	.57*	.44	.63*	.77**	1									
6. ER_IMP	.33	.39	.22	.60*	.64*	1								
7. ER_AWR	.45	.45	.52	.67*	.61*	.68*	1							
8. ER_STG	.51	.36	.53	.81**	.83**	.72**	.45	1						
9. ER_TOT	.58*	.44	.69**	.92**	.92**	.74**	.73**	.91**	1					
10. S_DES	.08	-.18	.13	-.19	-.23	-.16	.13	-.36	-.19	1				
11. DB	.29	.01	.55	.74**	.81**	.42	.42	.72**	.78**	.00	1			
12. HYP	.59*	.28	.71**	.67*	.77**	.27	.48	.67*	.75**	-.15	.74**	1		
13. B_DX	.64*	.15	.54	.16	.42	.06	.26	.38	.37	.11	.36	.51	1	
14. HYP_C	.31	.12	.38	.45	.56*	.39	.34	.46	.52	.38	.69**	.62*	.12	1

*Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed). Abbreviations: A_ANX, Romantic Attachment Anxiety; A_AVD, Romantic Attachment Avoidance; ER_CLAR, Emotion Regulation Clarity; ER_NOA, Emotion Regulation Nonacceptance; ER_GOL, Emotion Regulation Goals; ER_IMP, Emotion Regulation Impulsivity; ER_AWR, Emotion Regulation Awareness; ER_STG, Emotion Regulation Strategies; ER_TOT, Global Emotion Regulation; S_DES, Social Desirability; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation; B_DX, Breathing problem diagnosis; HYP_C, Hyperventilation categories of clinically normal, mild, and clinically significant.

Research question 3. A simultaneous entry multivariate multiple regression was used in the analysis research question 3 to test the hypotheses that significant variance in attachment (anxiety and avoidance) is accounted for by symptoms of hyperventilation and dysfunctional breathing in a young adult sample. The multivariate multiple regression testing attachment anxiety and attachment avoidance on symptoms of dysfunctional breathing and hyperventilation was not significant (Λ =.708, $F_{4,8} = .85$, $p = .513$). The full results for this analysis are shown in Table 25.

Table 25

Pilot Study Multivariate Multiple Regression Results for Research Question 3

Variables	**Λ**	***F***	***p***
Dependent Variables – Romantic Attachment Anxiety and Avoidance			
Overall Fit of the Model	.708	.85	.513
DB	.972	.13	.880
HYP	.838	.87	.450

Abbreviations: DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation.

Research question 4. A simultaneous entry multiple regression was used to analyze research question 4. The regression testing emotion regulation (the DERS total score) on attachment anxiety, attachment avoidance, symptoms of dysfunctional breathing and hyperventilation was significant (adjusted R^2 = .71, $F_{4,8} = 8.26$, $p < .01$). Symptoms of dysfunctional breathing (SEBQ total score) was the only significant predictor of emotion regulation in the model ($t = 2.75$ $p = .025$). The full results are shown in table 26.

Table 26

Pilot Study Multiple Regression Results for Research Question 4

Predictor Variable	β	*t*	*p*	ΔR^2	Adjusted ΔR^2
Research Question 4 Criterion – Emotion Regulation (DERS Total)					
Fit of the Model			.006	.81	.71
DB	.67	2.75	.025		
HYP	.10	.36	.725		
A_ANX	.08	.32	.758		
A_AVD	.36	1.63	.141		

Abbreviations: A_ANX, Romantic Attachment Anxiety; A_AVD, Romantic Attachment Avoidance; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation.

Research question 5. A hierarchical multiple regression was used to analyze research question 5 testing romantic attachment dimensions (anxiety and avoidance) as moderators of the relationship between breathing symptoms (dysfunctional breathing and hyperventilation) and emotion regulation (the DERS total score). To minimize multicollinearity issues and maximize the ease of interpretation, moderator and independent variables were centered prior to calculating interaction terms (Frazier et al., 2004). In the first hierarchical block, the two hypothesized moderators were included (romantic attachment anxiety and avoidance), in the second block the two independent variables (dysfunctional breathing and hyperventilation) were added to the regression model. Finally, in the third block the four interaction terms (attachment anxiety and hyperventilation, attachment anxiety and dysfunctional breathing, attachment avoidance and hyperventilation, and attachment avoidance and dysfunctional breathing) were added to the model predicting global emotion regulation difficulty. Entering the interaction

terms in the final block after the blocks with the predictor and moderator variables helps to reduce the inflated Type I error that can occur when testing multiple moderators in a single model (Frazier et al., 2004). Since the third model accounted for a significant portion of the variance in emotion regulation difficulty (adjusted R^2 = .89, $F_{8,4} = 12.68$, $p = .013$) it is recommended that the results of the first two steps are disregarded (Edwards, 2008). In step three the individual contributions of dysfunctional breathing ($t = 1.34$, $p = .007$) and the interaction between attachment avoidance and hyperventilation ($t = 3.52$, $p = .024$) were significant. As such, romantic attachment avoidance may have a moderating effect on the relationship between hyperventilation and emotion regulation.

It is important to note that these results were impacted by multicollinearity issues. Though there were no significant issues of multicollinearity in the first two models, there were significant issues of multicollinearity in the third model as evidenced by VIF values greater than 4 for the variables of attachment avoidance, dysfunctional breathing, hyperventilation, the interaction between attachment anxiety and dysfunctional breathing, and the interaction between attachment anxiety and hyperventilation, and the interaction between attachment avoidance and hyperventilation. Further, there are high correlations between: hyperventilation and dysfunctional breathing (r = .74, p < .01), the interaction between attachment anxiety and dysfunctional breathing and the interaction between attachment anxiety and hyperventilation (r = .87, p < .01), and the interaction between attachment avoidance and dysfunctional breathing and the interaction between attachment anxiety and hyperventilation (r = .74, p < .01). The VIF values are reported

in Table 28 and a correlation matrix of the variables and interaction terms are reported in Table 27. Also, with the interaction terms included in the regression equation the standardized β are not thought to be properly standardized so both the standardized and unstandardized β are reported in Table 28. These slope coefficients should be interpreted with caution (Frazier et al., 2004). The full results of this analysis are shown in table 28.

Table 27

Pilot Study Research Question 5 Correlations

	1	2	3	4	5	6	7	8
1. ANX	1							
2. AVD	.67*	1						
3. DB	.29	.00	1					
4. HYP	.59*	.28	.74**	1				
5. ANX*DB	-.08	-.15	-.52	-.43	1			
6. ANX*HYP	-.04	-.10	-.36	-.19	.87**	1		
7. AVD*DB	-.19	-.42	-.48	-.49	.74**	.52	1	
8. AVD*HYP	-.16	-.25	-.55	-.17	.49	.64*	.41	1

*Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level. Abbreviations: ANX, Romantic Attachment Anxiety; AVD, Romantic Attachment Avoidance; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation.

Table 28

Pilot Study Hierarchical Multiple Regression Results for Research Question 5

Predictor Variable	β (unstandardized)	β (standardized)	*t*	*p*	ΔR^2	Adjusted ΔR^2	VIF
Dependent Variable – Emotion Regulation (DERS Total)							
Fit of Model 1				.123	.34	.21	
A_ANX	.61	.52	1.49	.167			1.82
A_AVD	.11	.10	.29	.782			1.82
Fit of Model 2				.006	.81	.71	
A_ANX	.10	.08	.32	.758			2.70
A_AVD	.40	.36	1.63	.141			1.97
DB	1.51	.67	2.75	.025			2.46
HYP	.28	.10	.36	.725			3.32
Fit of Model 3				.013	.96	.89	
A_ANX	.13	.11	.59	.586			3.80
A_AVD	.57	.51	2.57	.062			4.21
DB	3.02	1.34	5.17	.007			7.12
HYP	-.92	-.34	1.47	.217			5.55
A_ANX*DB	.10	.80	2.43	.072			11.42
A_ANX*HYP	-.11	-.73	2.43	.072			9.40
A_AVD*DB	-.06	-.43	2.24	.088			3.92
A_AVD*HYP	.17	.76	3.52	.024			4.85

Abbreviations: A_ANX, Romantic Attachment Anxiety; A_AVD, Romantic Attachment Avoidance; DB, Symptoms of dysfunctional breathing; HYP, symptoms of hyperventilation